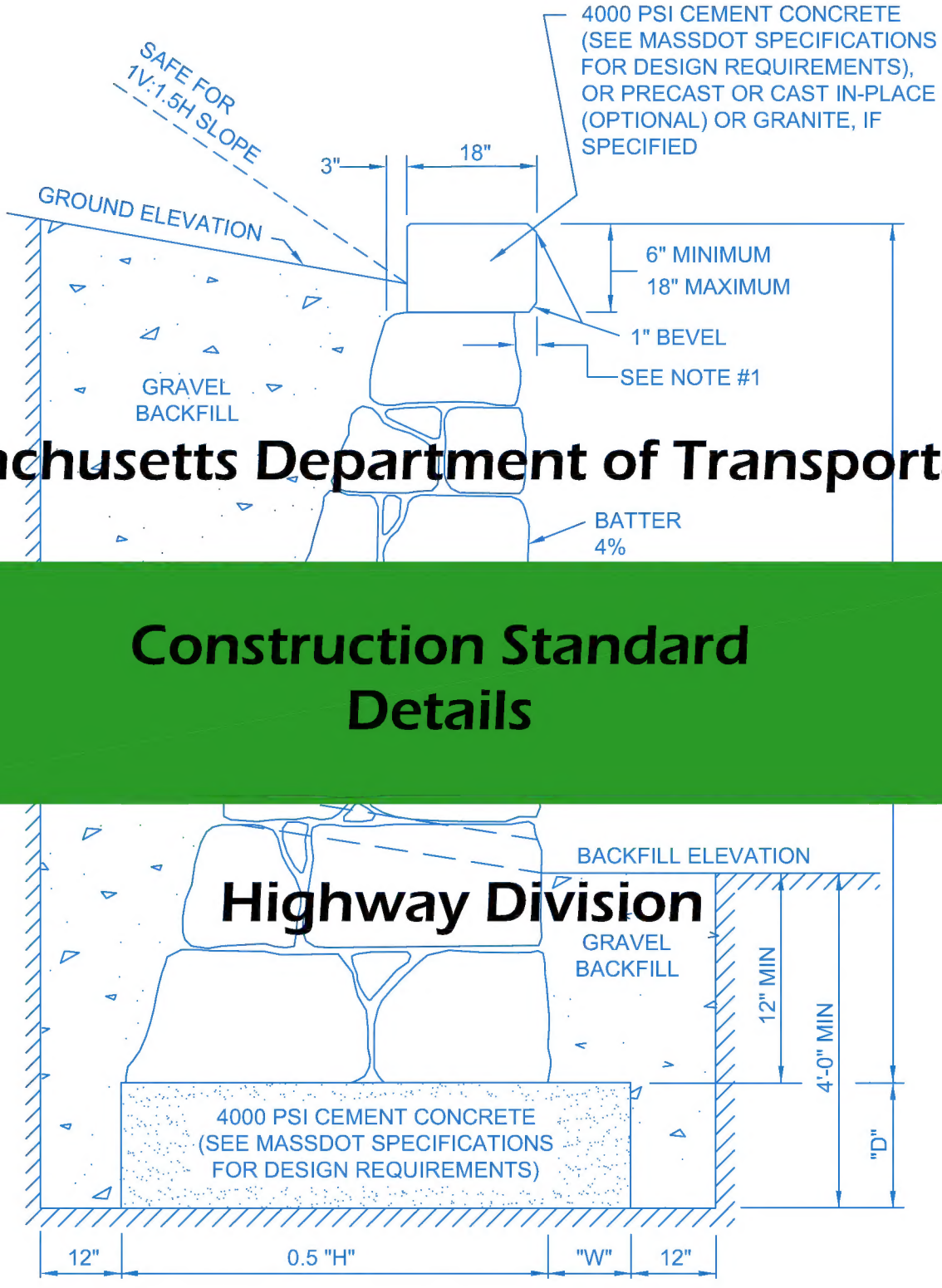


Massachusetts Department of Transportation

Construction Standard Details

Highway Division

massDOT
Massachusetts Department of Transportation
Highway Division

OCTOBER 2017

EXAMPLE: DRAWING NUMBER - 201.1.0

SECTION NUMBER (1,2,3,4 OR 5)
(100, 200, 300, 400 OR 500 SERIES)

- SECTION 1 (100 SERIES)
  HIGHWAY DESIGN AND PAVEMENT DETAILS
- SECTION 2 (200 SERIES)
  DRAINAGE
- SECTION 3 (300 SERIES)
  CEMENT CONCRETE, MASONRY STANDARDS
- SECTION 4 (400 SERIES)
  HIGHWAY GUARD RAIL AND FENCES
- SECTION 5 (500 SERIES)
  MISCELLANEOUS

CATEGORY IN SERIES:

- 01 FOR CATCH BASINS
- 02 FOR MANHOLES
- 03 FOR DROP INLETS, ETC.

DRAWING NUMBER IN EACH CATEGORY

AUXILIARY DRAWING NUMBER:
A NUMBER OTHER THAN ZERO WILL APPEAR IN THIS POSITION WHEN IT IS SUBSEQUENTLY NECESSARY TO INSERT ONE OR MORE ADDITIONAL DRAWINGS BETWEEN TWO EXISTING DRAWING NUMBERS IN THE SAME CATEGORY.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

KEY TO NUMBERING SYSTEM

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
KEY 1

DESCRIPTION | DRAWING NUMBER

SECTION 1
HIGHWAY DESIGN AND PAVEMENT DETAILS

DESCRIPTION | DRAWING NUMBER

SECTION 2
DRAINAGE

DESCRIPTION | DRAWING NUMBER

SECTION 3
CEMENT CONCRETE & MASONRY STRUCTURES CONT.

SECTION 4
HIGHWAY GUARD RAIL & FENCES

DESCRIPTION | DRAWING NUMBER

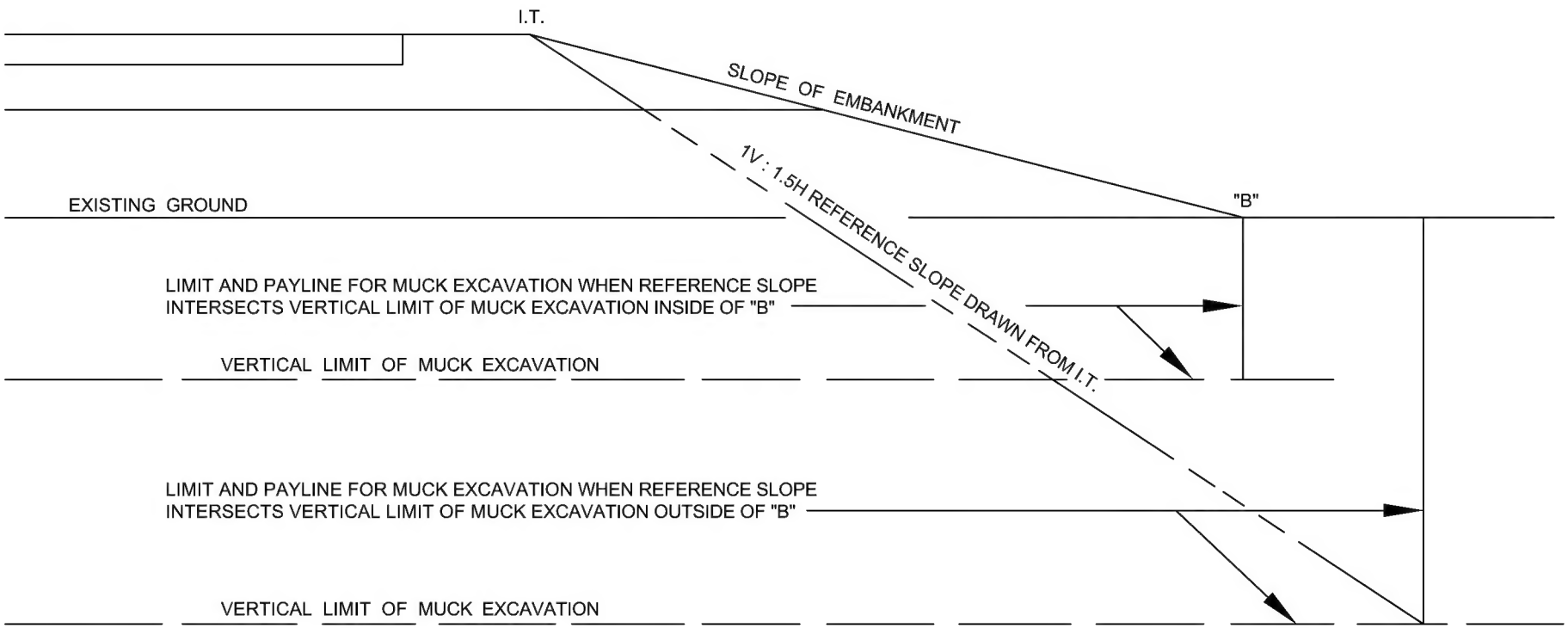
SECTION 4
HIGHWAY GUARD RAIL & FENCES CONT.

SECTION 5
MISCELLANEOUS

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

LIMIT OF MUCK EXCAVATION



NOTES:

1. "B" - INTERSECTION OF EXISTING GROUND AND SLOPE OF EMBANKMENT
2. THE ABOVE METHOD MAY ALSO BE USED TO DETERMINE THE LIMIT FOR EXCAVATION OF OTHER UNSUITABLE MATERIALS
3. I.T. - INTERSECTION OF TANGENT

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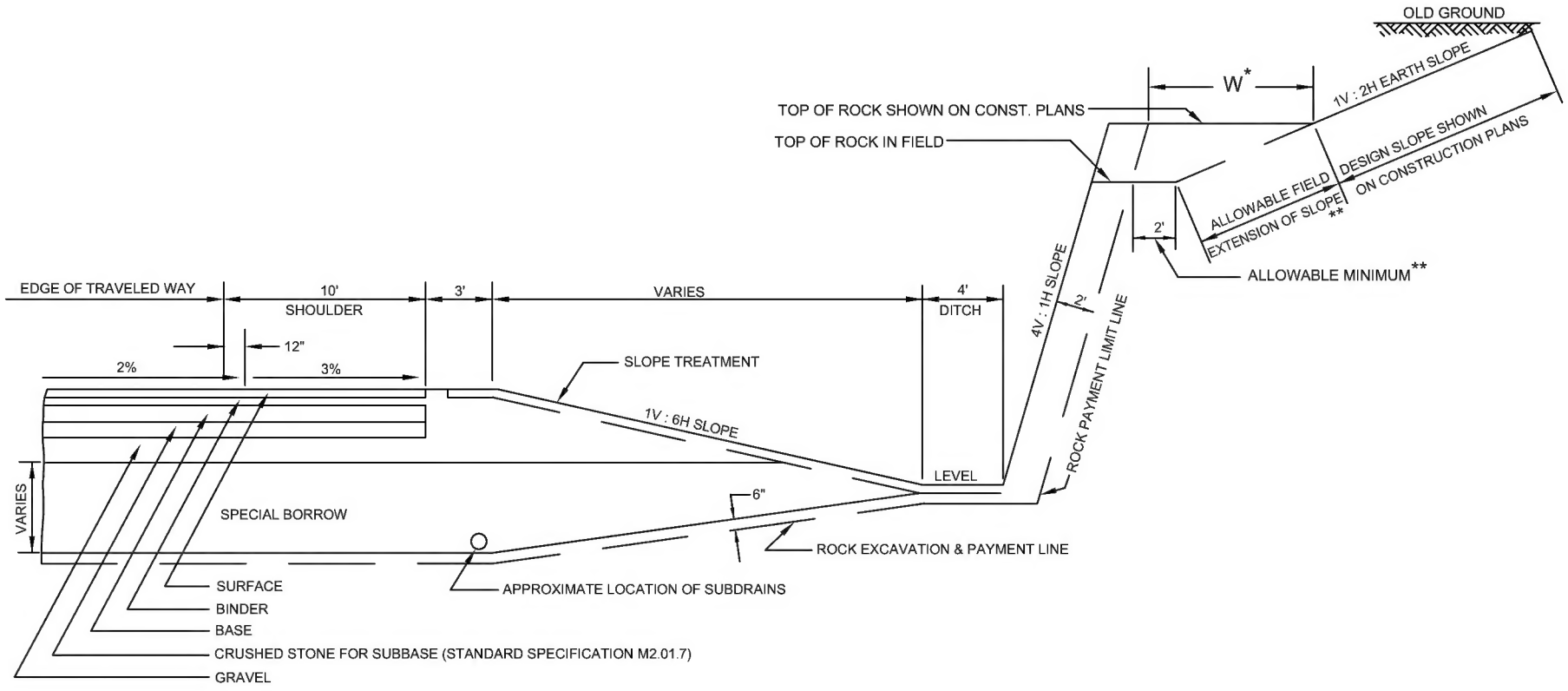
OCTOBER 2017

DRAWING NUMBER
E 101.1.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

ROCK CUT SELECTION



* DESIGN
- W=12' FOR ROCK CUTS OF 20' OR LESS
- W=17' FOR ROCK CUTS 25' OR MORE
- W-VARIES 12' - 17' FOR ROCK CUTS BETWEEN 20' - 25'; DETERMINE PROPORTIONATELY

** THE EXTENSION OF THE DESIGN SLOPE IN THE FIELD IS PERMISSIBLE WITHIN THE LIMITS SHOWN (2' SHELF ON TOP OF THE ROCK), WHEN THE HEIGHT OF THE ROCK CUT IN THE FIELD IS LESS THAN THAT SHOWN ON THE CONSTRUCTION PLANS

NOTES:

1. ONLY ROCK ACTUALLY REMOVED IS PAYABLE. NO PAYMENT WILL BE MADE BEYOND THE ROCK PAYMENT LINE

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DRAWING NUMBER
E 102.1.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

METHOD OF ROUNDING SLOPES
CUT AND FILL SLOPES

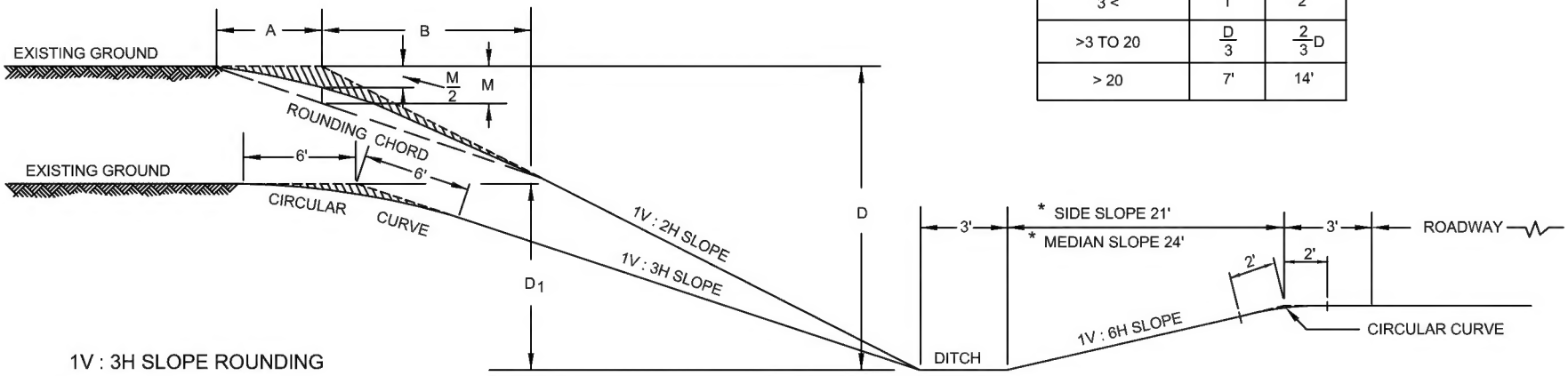
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 103.1.0

METHOD OF ROUNDING CUT SLOPES

ROUNDING TABLE FOR 1V : 2H SLOPE

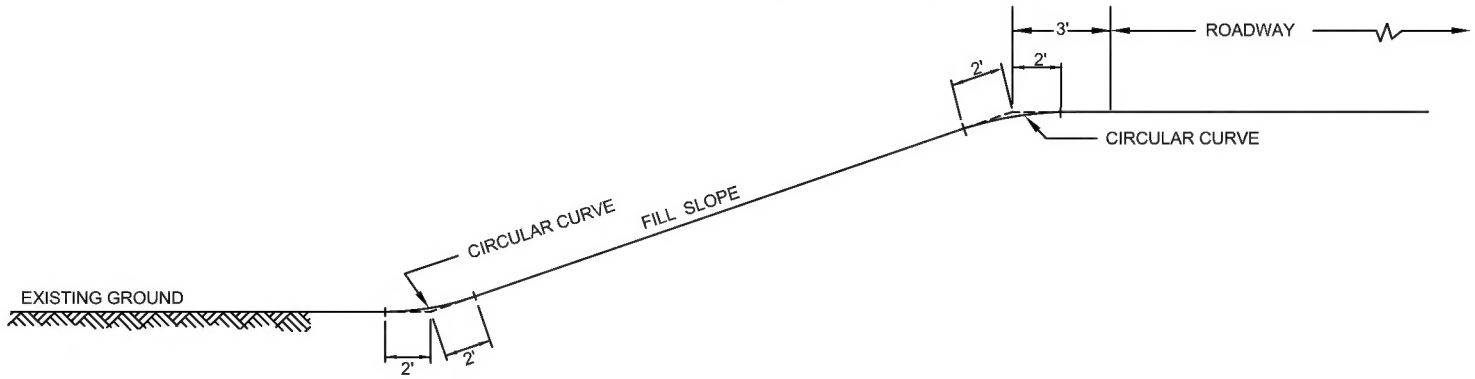
D FEET	A	B
3 <	1'	2'
>3 TO 20	$\frac{D}{3}$	$\frac{2}{3}$D
> 20	7'	14'



1V : 3H SLOPE ROUNDING

1. WHEN "D1" IS 2' OR MORE ROUND AS SHOWN IN TABLE ABOVE.
2. WHEN "D1" IS LESS THAN 2' ROUND FULL LENGTH OF SLOPE.

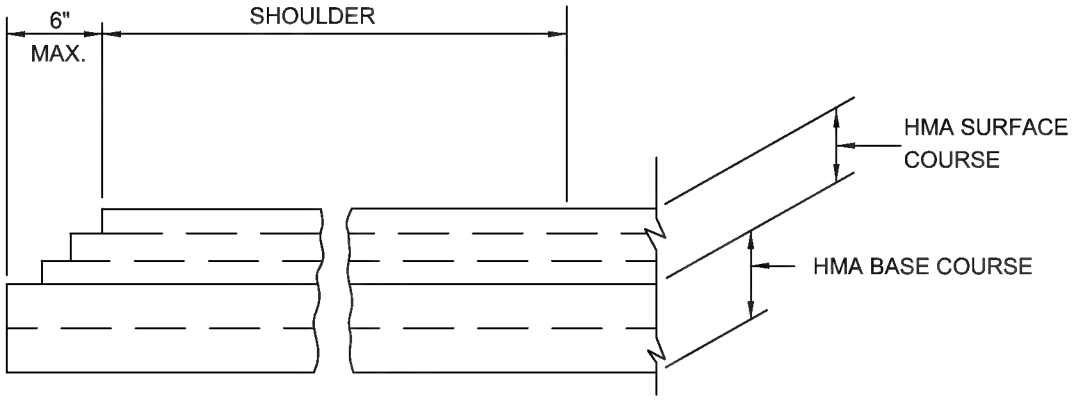
METHOD OF ROUNDING FILL SLOPES



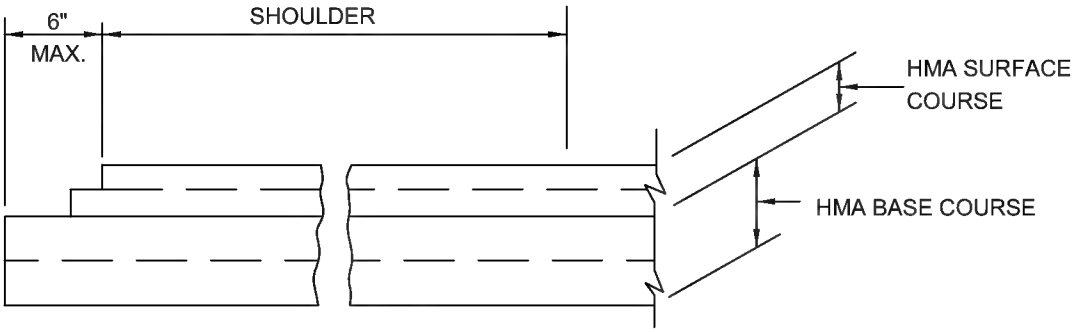
* USE SLOPE LENGTHS FOR LIMITED ACCESS OR HIGH SPEED ROADWAYS.

NOTE:

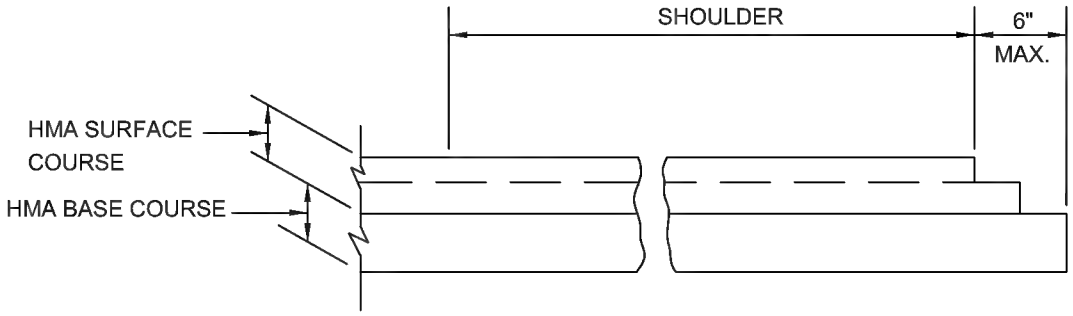
1. THE DIMENSIONS SHOWN FOR ROUNDING CUT AND FILL SLOPES ARE APPROXIMATE; THEY ARE TO BE USED AS GUIDES.



3 - LAYERED SURFACE AND 2 - LAYERED BASE COURSE



2 - LAYERED SURFACE AND 2 - LAYERED BASE COURSE



2 - LAYERED SURFACE AND 1 - LAYER BASE COURSE

NOTES:

1. ONLY APPLICABLE STEPPING METHODS OF THIS DRAWING ARE TO BE SHOWN IN THE TYPICAL SECTION OF THE CONSTRUCTION PLANS. THIS SHALL BE SHOWN AS A SEPARATE DETAIL AND NOT INCLUDED ON EACH SECTION.
2. STEPPING SHALL NOT BE SHOWN ON THE CROSS SECTION TEMPLATES.
3. ADDITIONAL MATERIAL REQUIRED FOR STEPPING SHALL BE INCLUDED IN ESTIMATED QUANTITIES.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

METHOD OF STEPPING SURFACE AND BASE COURSE LAYERS

DATE OF ISSUE
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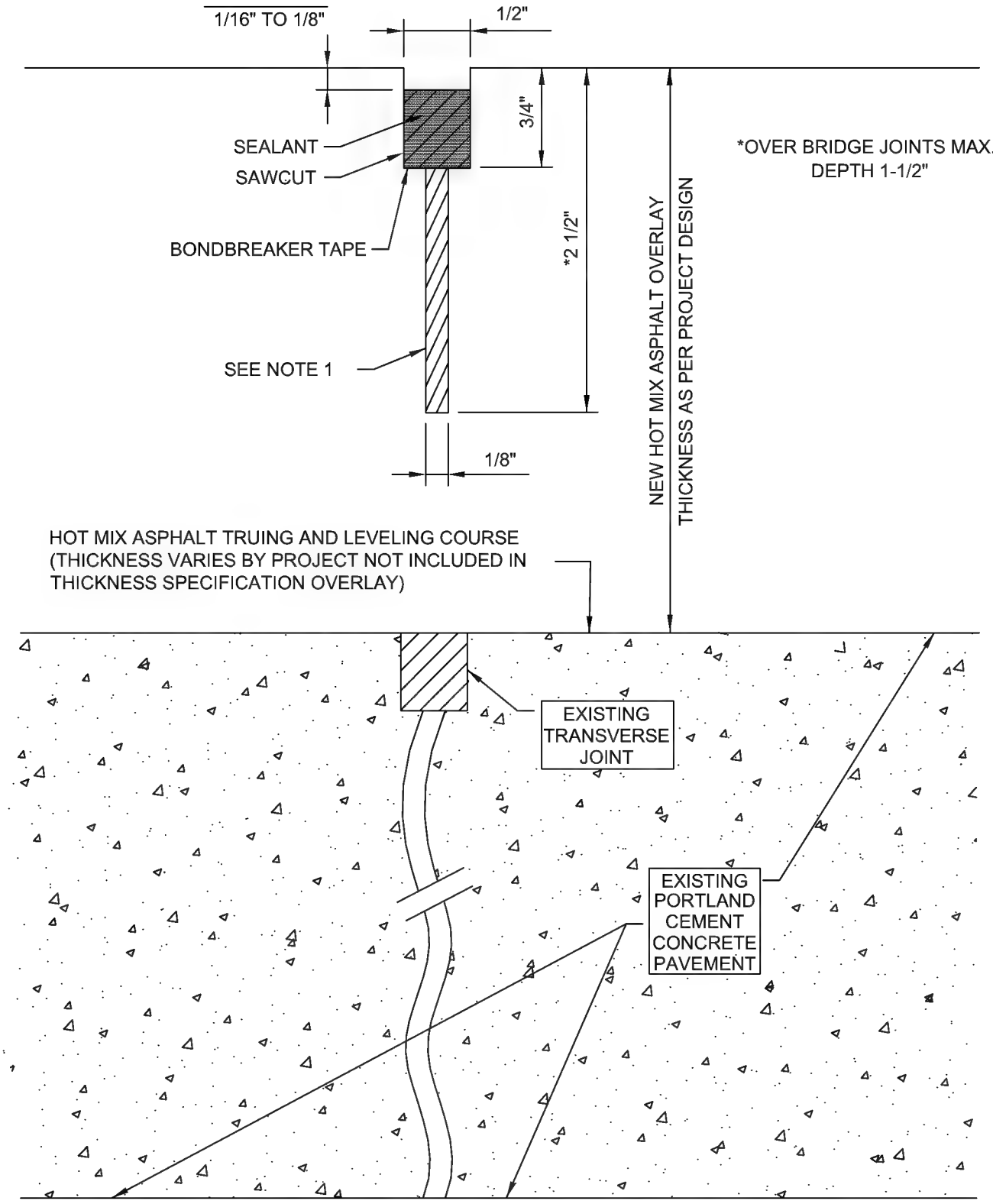
E 104.1.0



NOTES:

1. WHEN THE TOTAL THICKNESS OF HOT MIX ASPHALT OVER THE EXISTING JOINT EXCEEDS 4-3/8", A 1/8" SAWCUT SHALL BE INCLUDED IN THE JOINT AS SHOWN TO A MINIMUM DEPTH OF 2-1/2".
2. PRIOR TO PLACING THE OVERLAY, ALL JOINTS SHALL BE LOCATED AND REFERENCED.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

TRANSVERSE JOINTS AT EXPANSION JOINTS

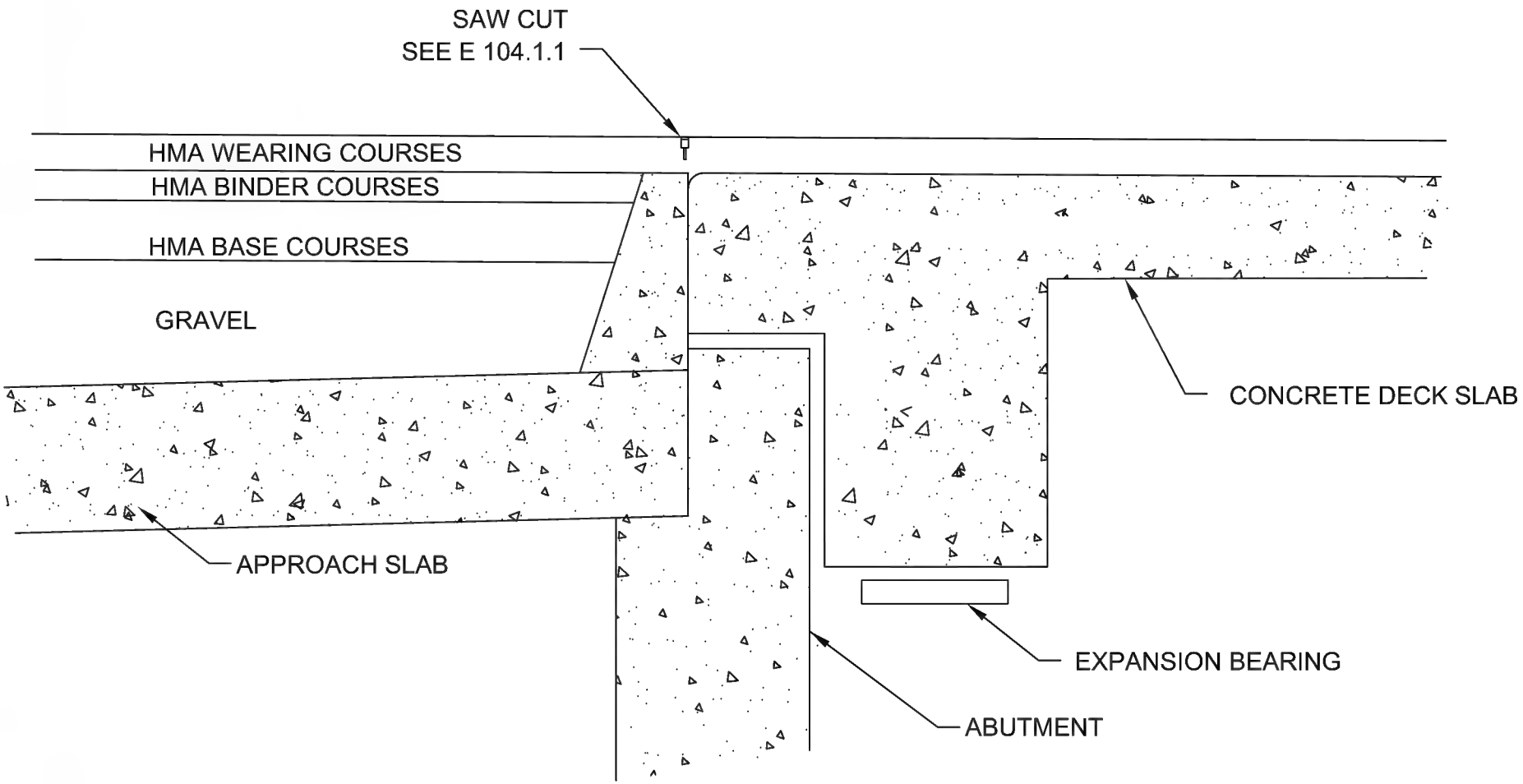
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 104.1.1

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

LOCATION OF SAW CUT FOR TRANSVERSE JOINTS AT BRIDGE ABUTMENT



NOTES:

1. BEFORE SAW-CUTTING THE TRANSVERSE JOINT THE CONTRACTOR SHALL LOCATE THE END OF THE BRIDGE DECK. SAW-CUTTING MUST TAKE INTO ACCOUNT THE SKEW ANGLE OF THE BRIDGE.
2. ONLY EXPANSION JOINTS SHALL BE SAW-CUT AND SEALED.
3. ONLY REQUIRED WITH A CONTINUOUS BITUMINOUS CONCRETE SURFACE FROM ROADWAY TO BRIDGE.

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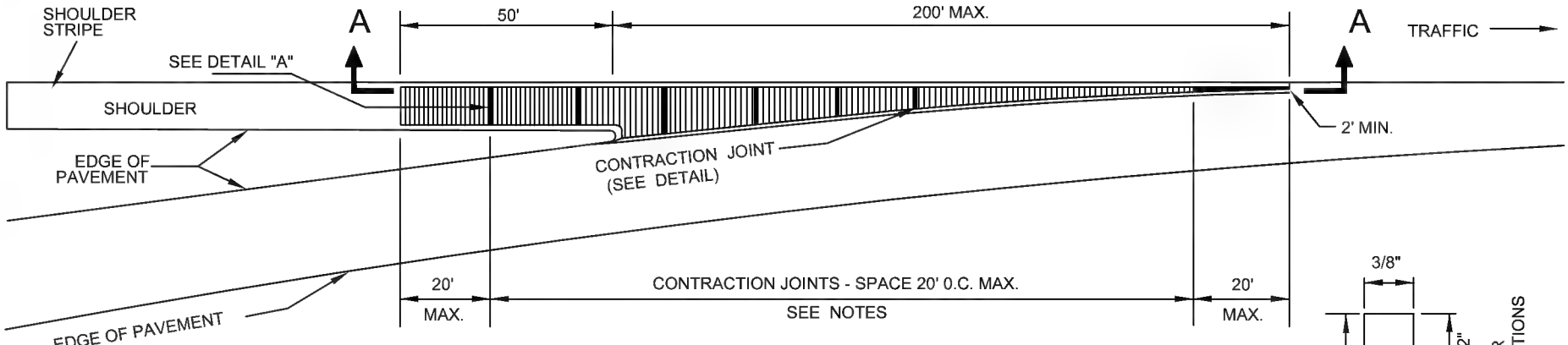
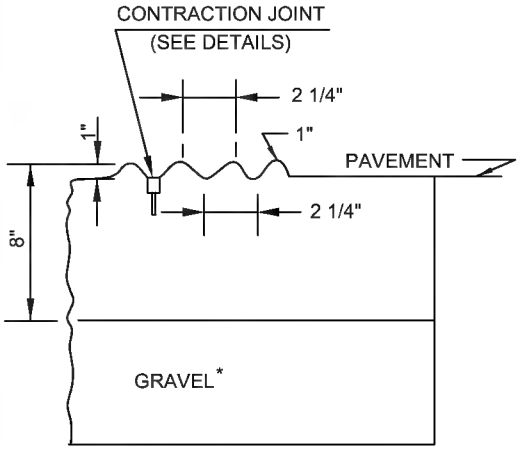
DRAWING NUMBER
E 104.1.2

CONSTRUCTION STANDARDS

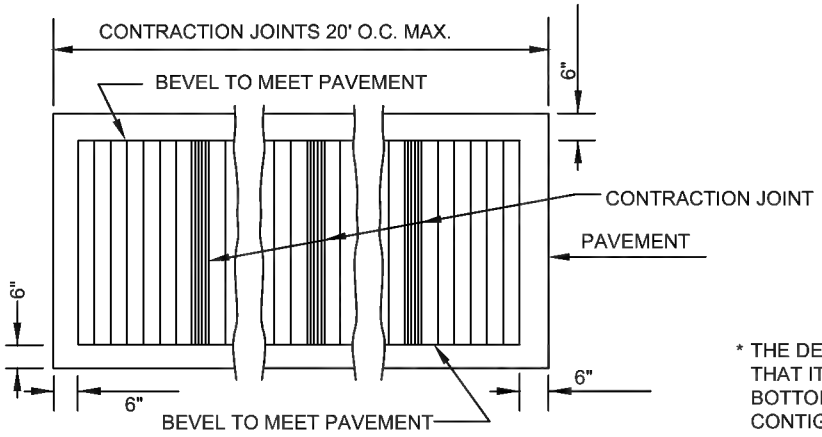
massDOT Highway Division — Massachusetts Department of Transportation

SCORED CEMENT CONCRETE PAVEMENT RAMPS

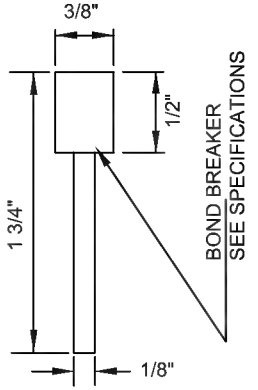




DETAIL OF CORRUGATIONS

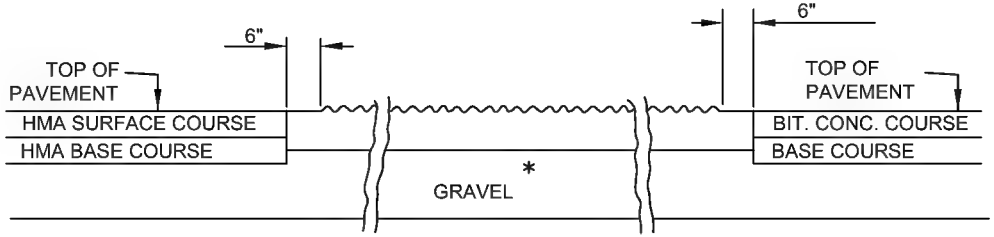


DETAIL "A"



CONTRACTION JOINT DETAIL

* THE DEPTH OF THE GRAVEL IS TO BE SUCH THAT ITS BOTTOM LINE MEETS THE BOTTOM OF THE GRAVEL LINE OF THE CONTIGUOUS PAVEMENT.



SECTION A - A

NOTES:

1. CONTRACTION JOINTS ARE TO BE SPACED AT A MAXIMUM OF 20' APART.
2. THE JOINTS ARE TO BE SAWED AND LOCATED IN THE DEPRESSIONS OF THE CORRUGATIONS, SEE DETAIL OF CORRUGATIONS.
3. END OF CORRUGATED RIDGES TO BE BEVELED.
4. FOR DESCRIPTION OF MATERIAL AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS.
5. SCORED CEMENT CONCRETE TO BE 5000 psi. SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS.
6. TROUGH FLUSH WITH OR ABOVE ADJACENT PAVEMENT FOR DRAINAGE.

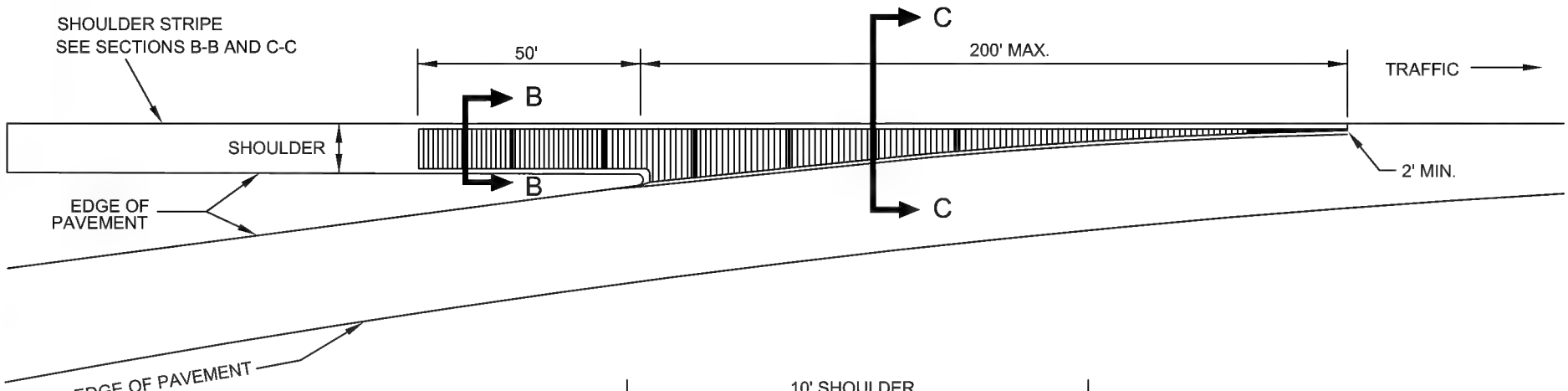
DRAWING NUMBER **E 105.2.0**

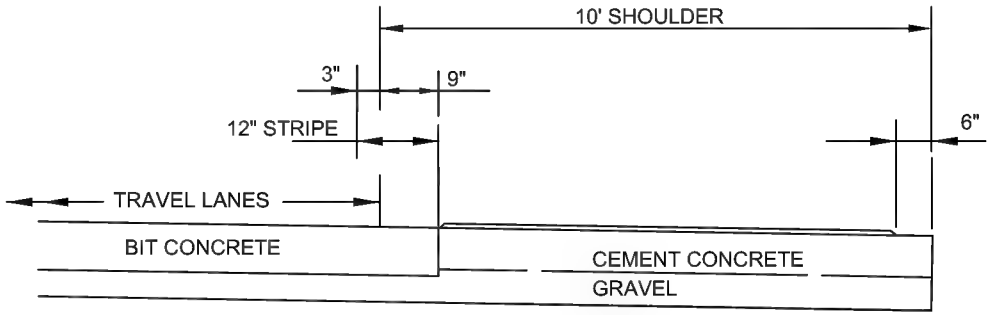
DATE OF ISSUE OCTOBER 2017

CONSTRUCTION STANDARDS

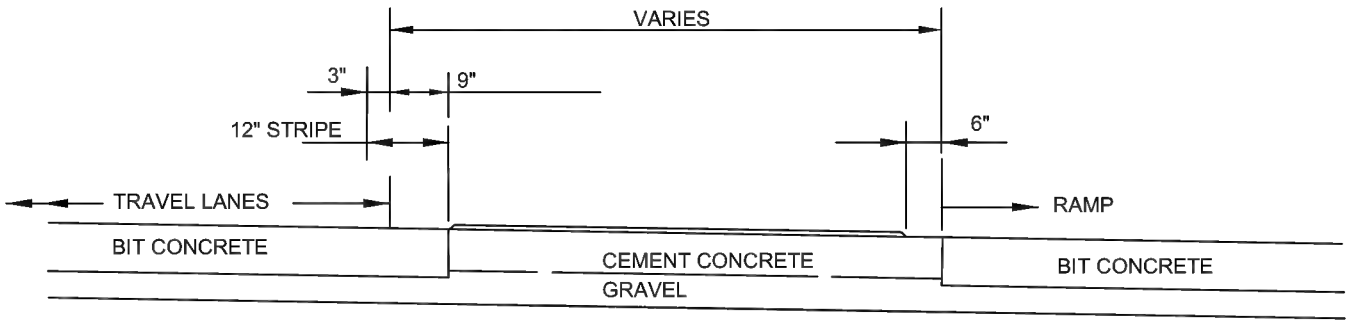
massDOT Highway Division

SHOULDER SECTION OF SCORED CEMENT CONCRETE PAVEMENT





SECTION B - B



SECTION C - C

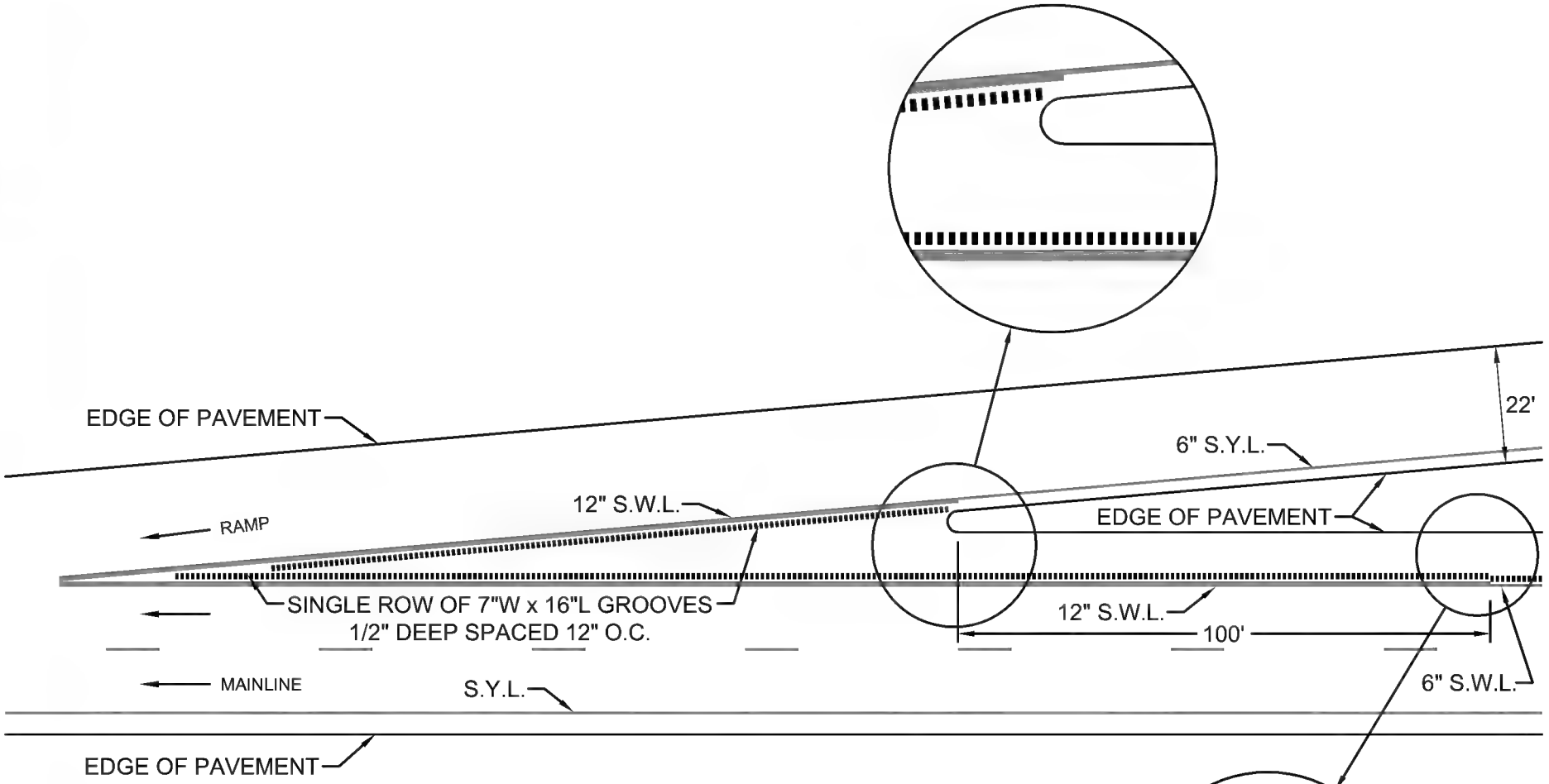
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 105.2.1

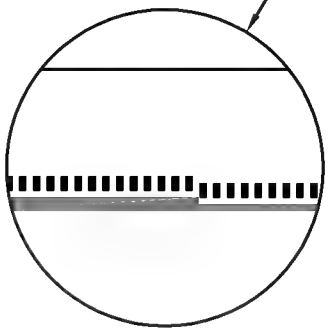
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

FREEWAY ENTRANCE RAMP DETAIL
RUMBLE STRIP INSTALLATION
AT GORE AREAS



ROADWAY PLAN



6" TO 12" EDGE LINE TRANSITION

NOTE:

FOR DETAIL OF MILLING AND SPACING OF GROOVES SEE DRAWING E 105.5.0, DETAIL A AND SECTION B-B.

DATE OF ISSUE
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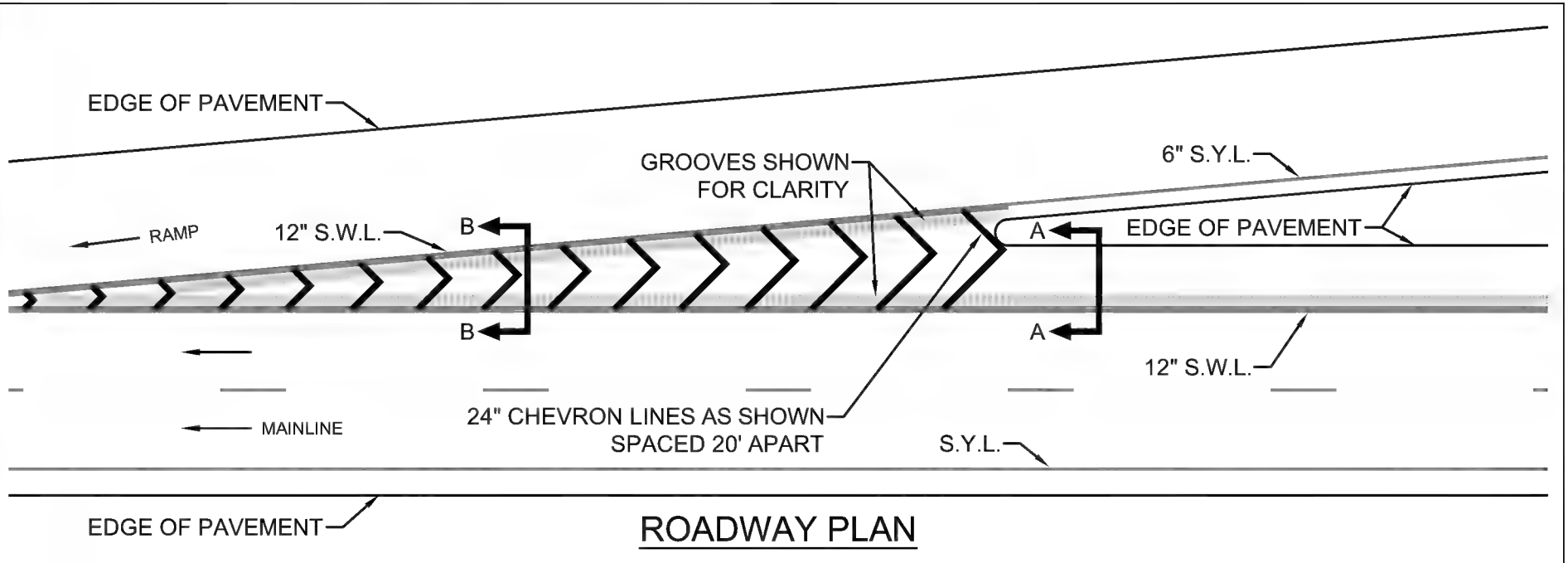
E 105.3.2

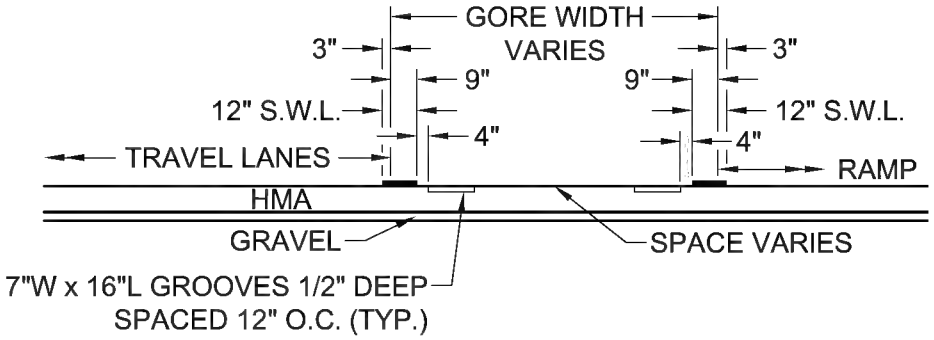
CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

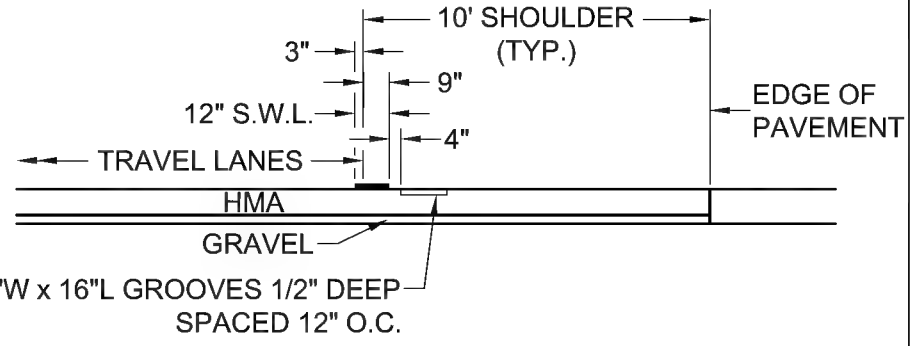
FREEWAY ENTRANCE RAMP DETAIL
PAVEMENT MARKING INSTALLATION
AT GORE AREAS



ROADWAY PLAN



SECTION B-B



SECTION A-A

NOTE:

SEE DRAWING E 105.3.2 FOR TRANSITION FROM 6" TO 12" LINES AND OTHER INFORMATION.

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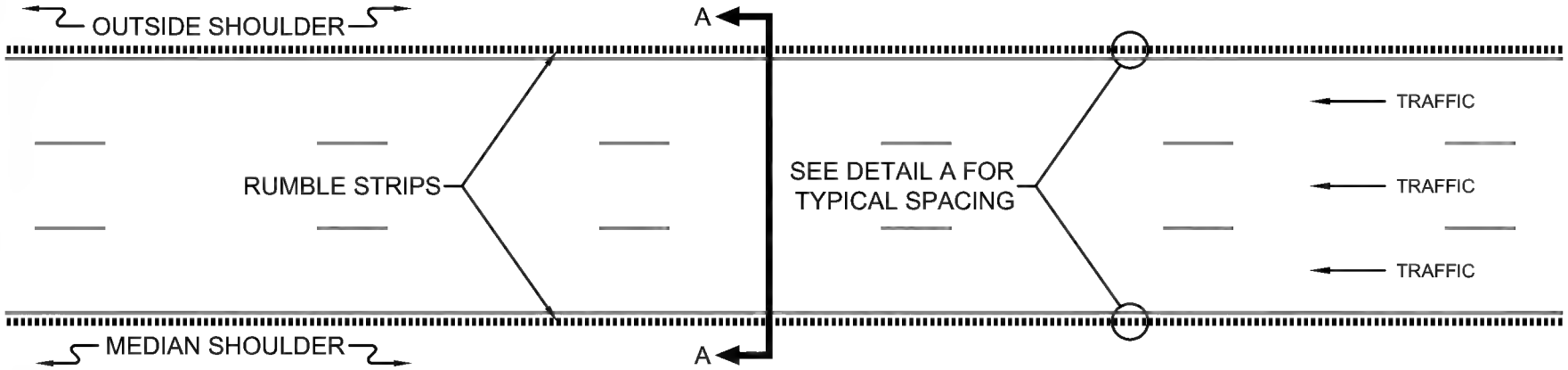
DRAWING NUMBER
E 105.3.3

CONSTRUCTION STANDARDS

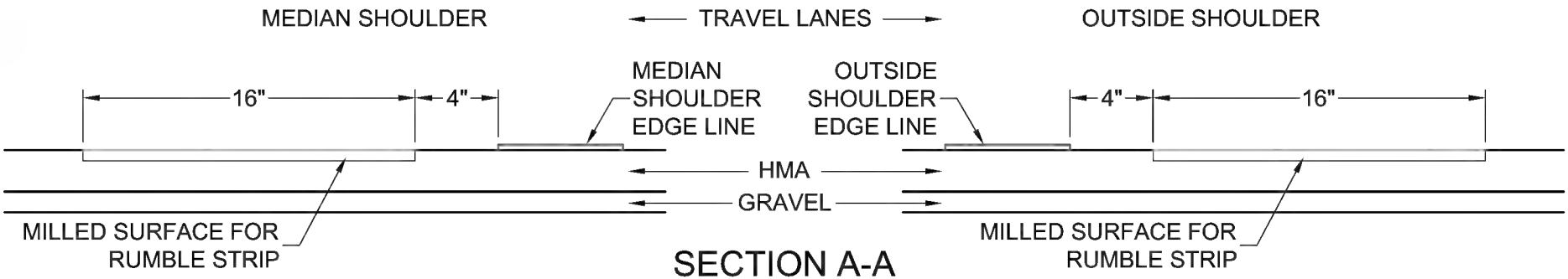
massDOT Highway Division

RUMBLE STRIP INSTALLATION DETAILS

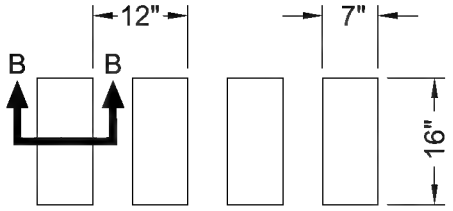
BICYCLES PROHIBITED



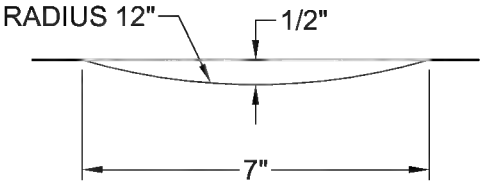
ROADWAY PLAN



SECTION A-A ROADWAY



DETAIL A TYPICAL SPACING PLAN



SECTION B-B

NOTES FOR RUMBLE STRIPS:

1. NOT TO BE INSTALLED ON SHOULDERS LESS THAN 2' WIDE.
2. NOT TO BE INSTALLED ON BRIDGE DECKS.

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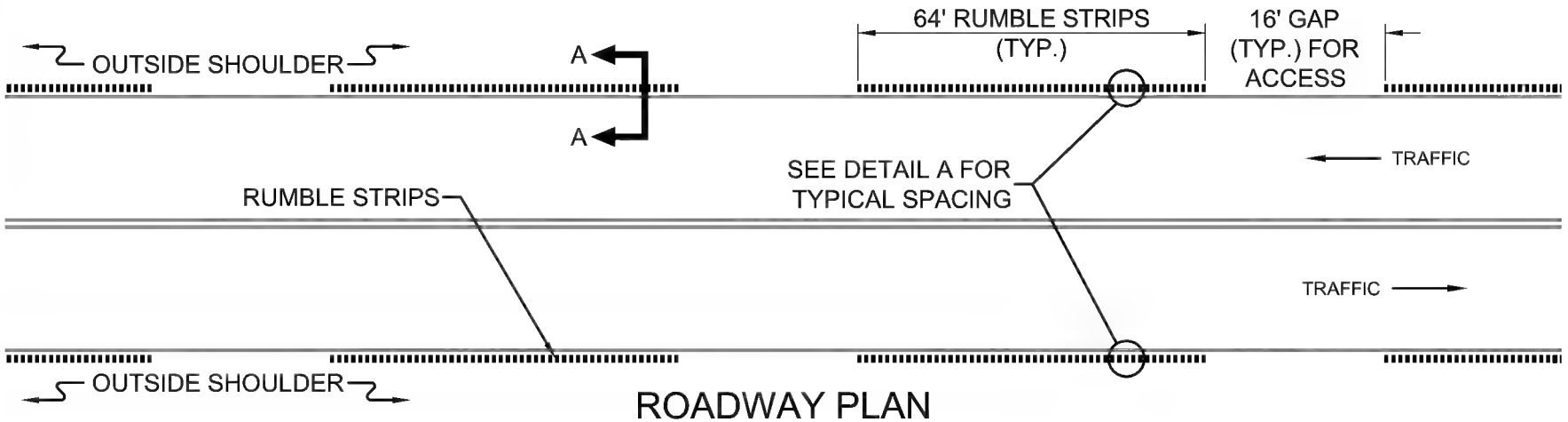
E 105.5.0

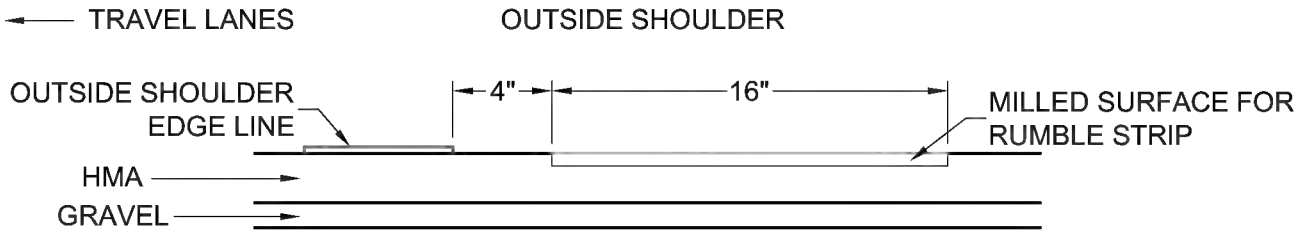
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

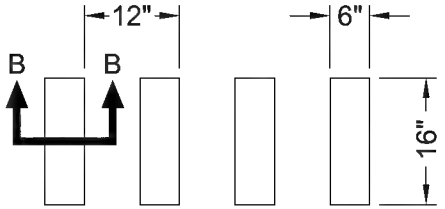
RUMBLE STRIP INSTALLATION DETAILS BICYCLES PERMITTED



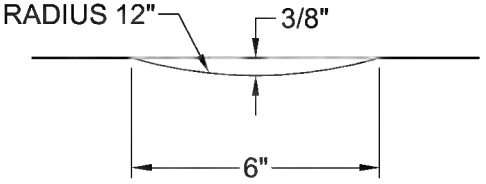
ROADWAY PLAN



SECTION A-A ROADWAY



DETAIL A TYPICAL SPACING PLAN



SECTION B-B

NOTES FOR RUMBLE STRIPS:

1. NOT TO BE INSTALLED ON SHOULDERS LESS THAN 8' WIDE.
2. NOT TO BE INSTALLED ON BRIDGE DECKS.

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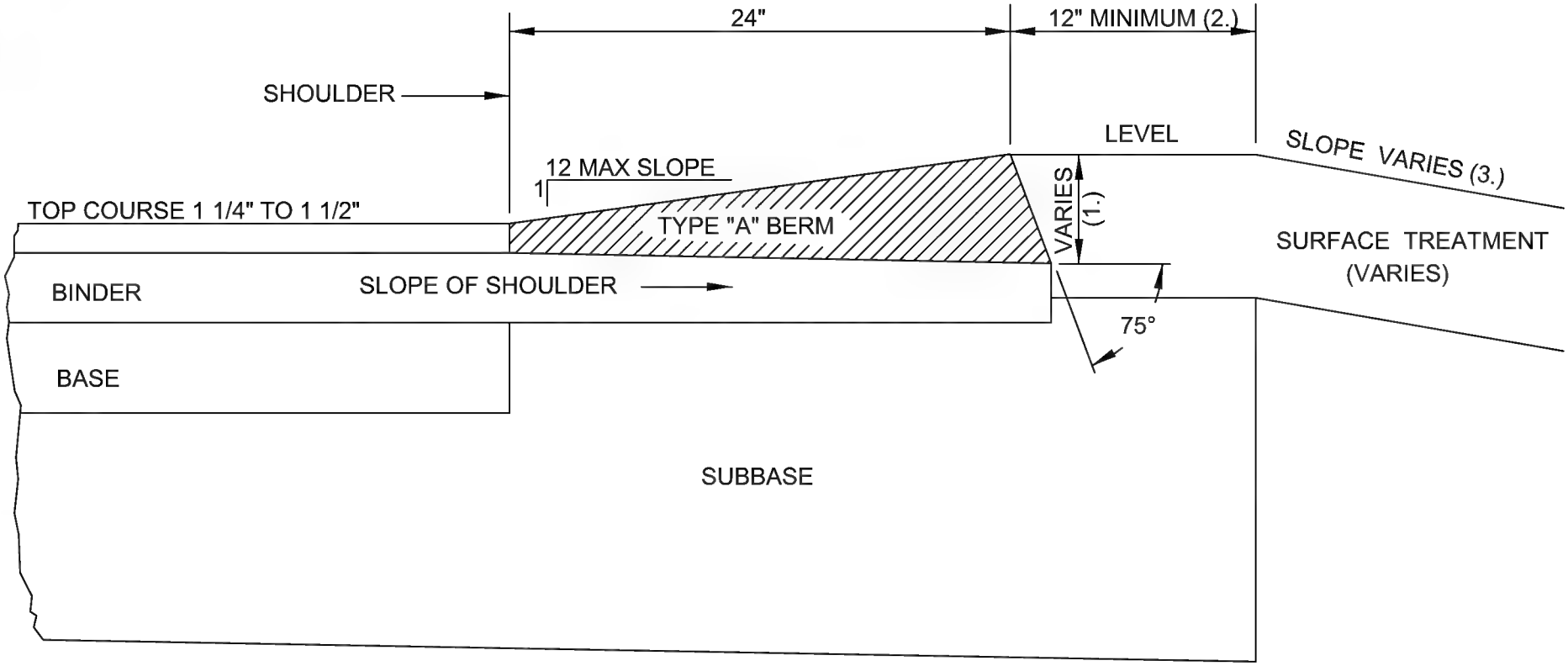
DRAWING NUMBER
E 105.7.0

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

HOT MIX ASPHALT BERM
TYPE A



NOTE:

FOR MODIFIED BERM THE SLOPE REMAINS CONSTANT AT 1 (V) TO 12 (H)

1. THIS DIMENSION VARIES WITH THE THICKNESS OF THE TOP COURSE AND SLOPE OF BINDER
2. SEE E 401.1.1 FOR TYPICAL SECTION AT GUARDRAIL LOCATIONS
3. SEE TYPICAL SECTIONS FOR PROJECT

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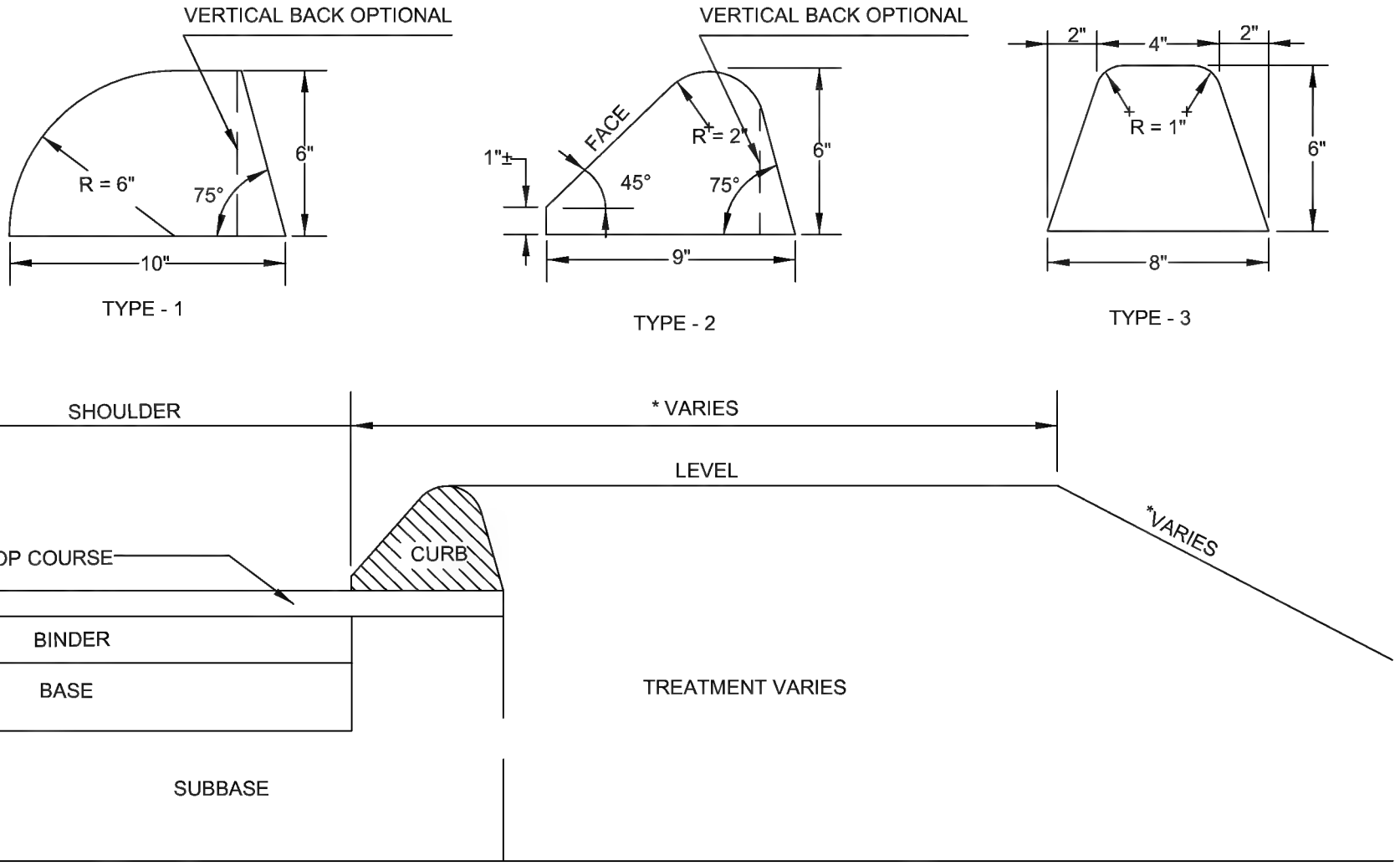
DRAWING NUMBER
E 106.1.0

CONSTRUCTION STANDARDS

massDOT Highway Division

HOT MIX ASPHALT CURBS



METHOD OF SETTING-TYPICAL FOR ALL TYPES

* SEE TYPICAL SECTIONS FOR PROJECT.

DATE OF ISSUE
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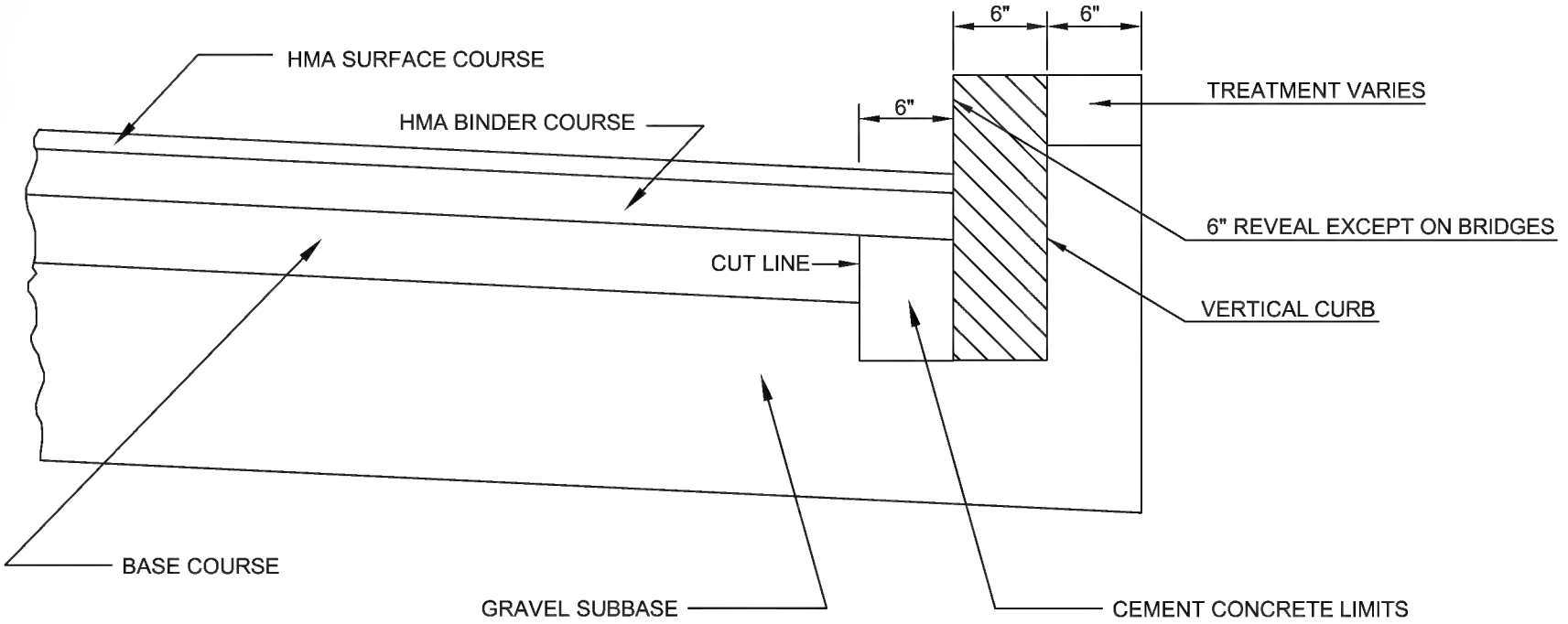
DRAWING NUMBER
E 106.2.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

METHOD OF SETTING VERTICAL CURB



NOTES:

1. THIS PROCEDURE IS APPLICABLE ONLY IF CURB IS TO BE SET AFTER BASE COURSE IS IN PLACE PRIOR TO BINDER AND TOP PLACEMENT.

2. CUT NEAT LINE 6" FROM CURB LINE AND REMOVE BASE AND GRAVEL. REPLACE WITH CEMENT CONCRETE.

3. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE UNDER SECTION M4 OF THE STANDARD SPECIFICATIONS MAY BE USED; ALL TEST REQUIREMENTS ARE WAIVED. HOT MIX ASPHALT SHALL NOT TO BE USED AS A SUBSTITUTE.

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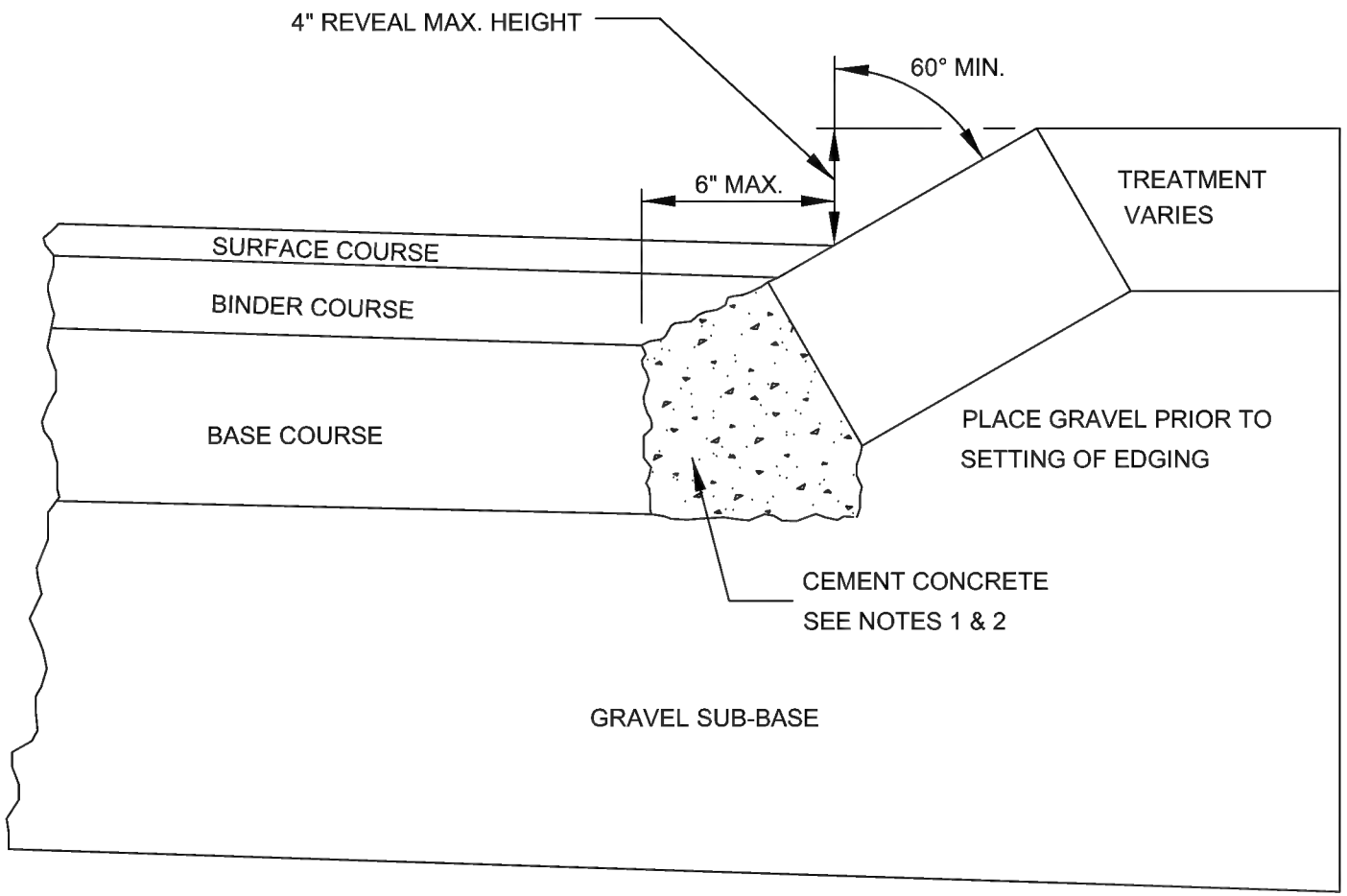
DRAWING NUMBER
E 106.3.0

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

METHOD OF SETTING
SLOPED EDGING



SLOPED EDGING

NOTES:

1. ANY DESIGNATED CEMENT CONCRETE THAT IS ACCEPTABLE TO THE DEPARTMENT UNDER SECTION M4 OF THE STANDARD SPECIFICATIONS; ALL TEST REQUIREMENTS ARE WAIVED. HOT MIX ASPHALT SHALL NOT TO BE USED AS A SUBSTITUTE.

2. THE REVEAL IS TO BE A MAXIMUM OF 4" UNDER ALL CONDITIONS, THE ANGLE IS TO BE A MINIMUM OF 60° FROM VERTICAL UNDER ALL CONDITIONS.

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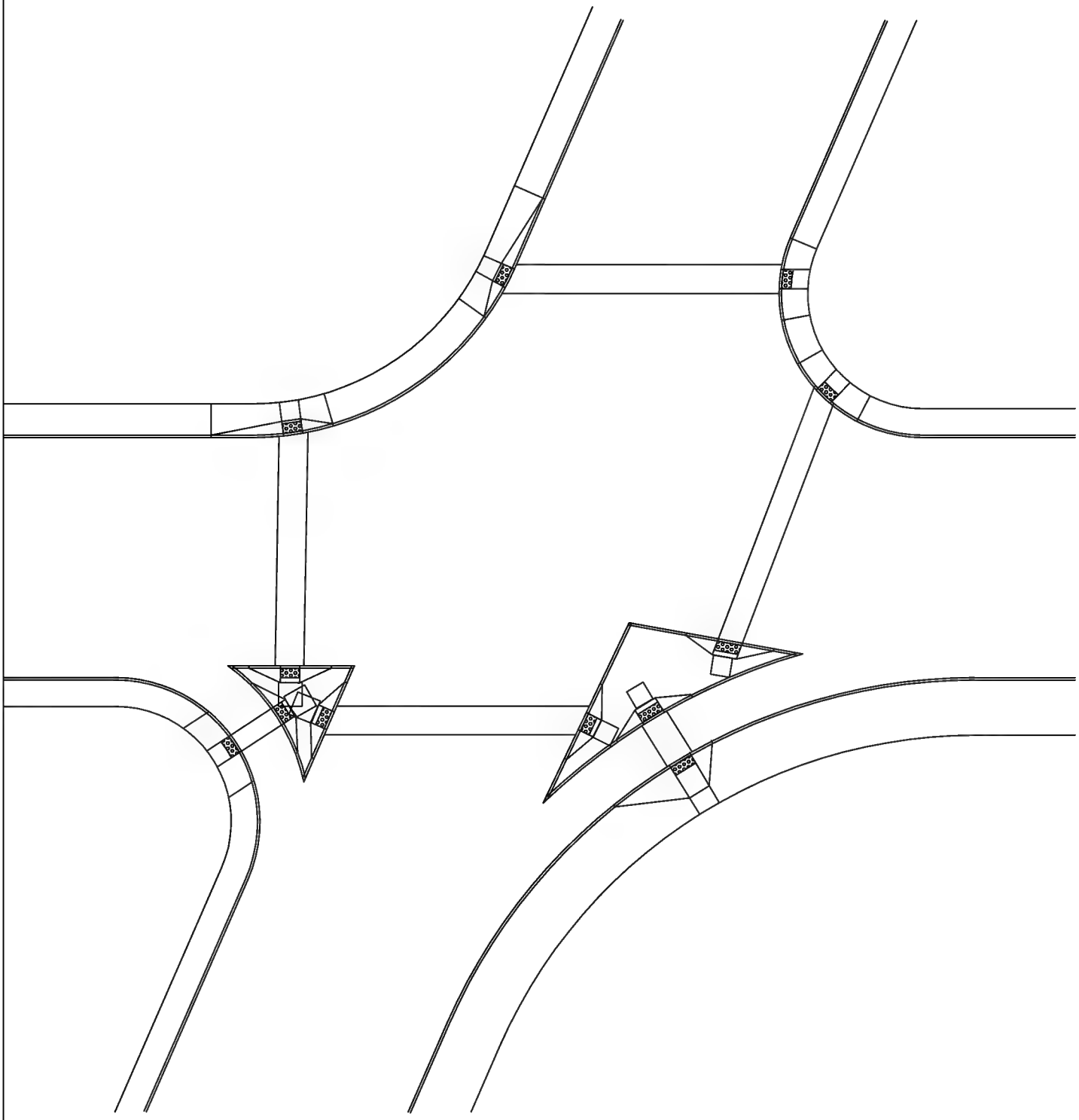
DRAWING NUMBER
E 106.5.0



NOTES:

1. LEVEL LANDINGS CAN OVERLAP
2. ISLAND AREAS SUBJECT TO TRAVEL SHOULD BE TREATED AS PLAZAS "NOT MORE THAN 2% SLOPE IN ANY DIRECTION"
3. ALL RAMPS BY REGULATION MUST BE PERPENDICULAR TO THE CURB AT THE GUTTER
4. RAMPS SHOULD BE BOTH ALIGNED TOWARD THE RECEIVING RAMP AND WITHIN THE GENERALLY PREFERRED PEDESTRIAN PHASE OF TRAFFIC

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

TYPICAL INTERSECTION CROSS WALK LAYOUT

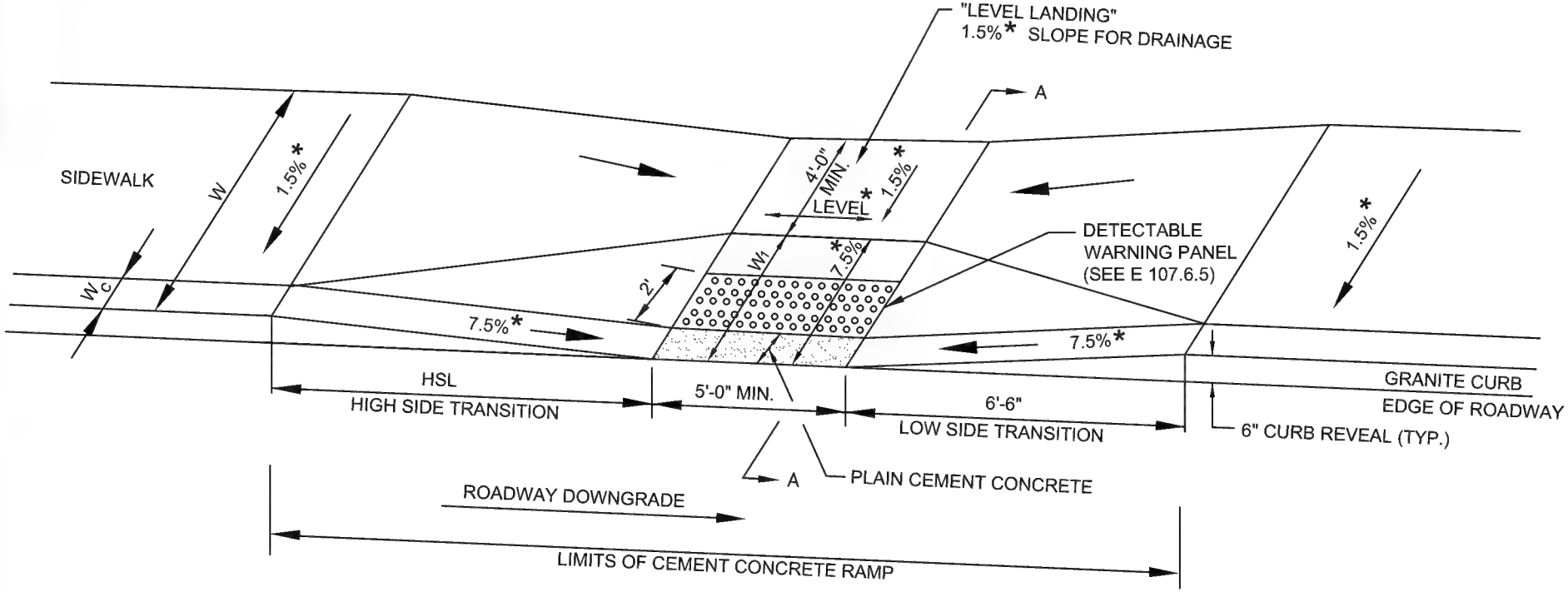
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.1.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

WHEELCHAIR RAMPS
LESS THAN 12'-4" SIDEWALK



LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)

W = SIDEWALK WIDTH

W_c = CURB WIDTH

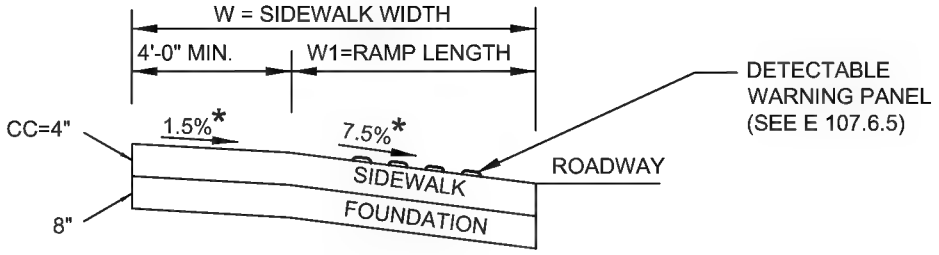
W_1 = PERPENDICULAR RAMP LENGTH

CC = CEMENT CONCRETE

* = TOLERANCE FOR CONSTRUCTION ±0.5%

USABLE SIDEWALK WIDTH PER AAB = W-Wc

RAMP LENGTH, W1 = W-4'-0" Min



SECTION A-A

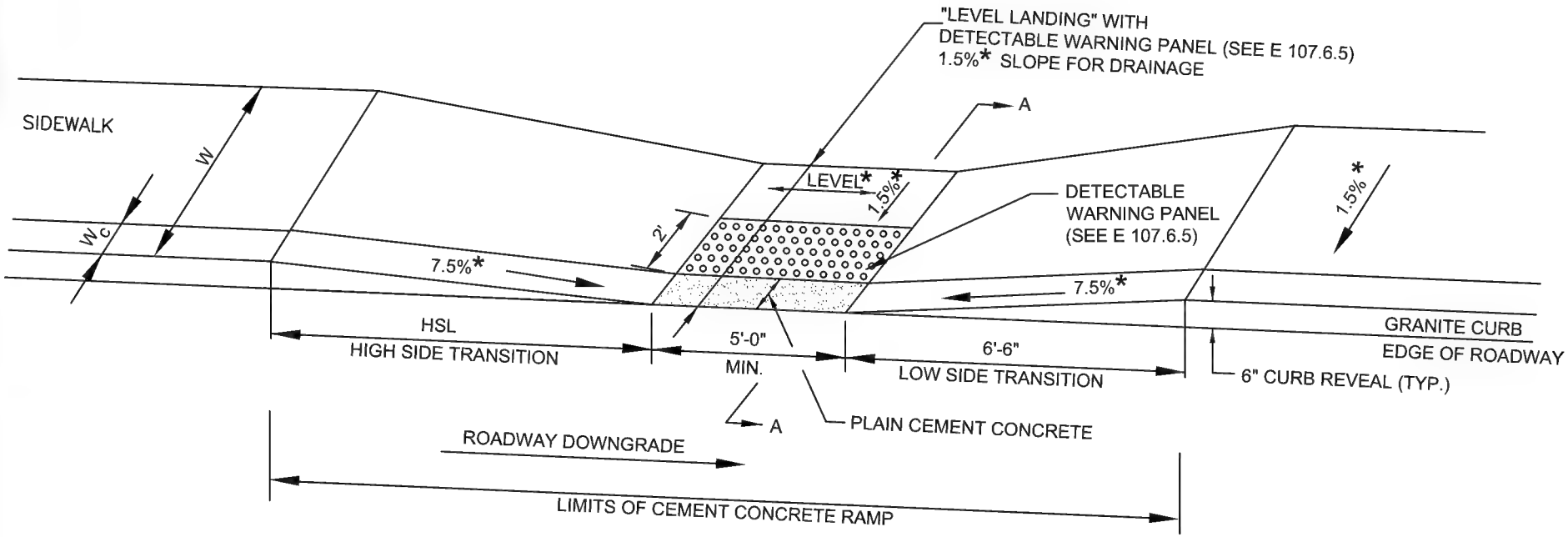
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.2.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

WHEELCHAIR RAMP ON NARROW SIDEWALK WITH DETECTABLE WARNING PANEL



LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)

W = SIDEWALK WIDTH

W_C = CURB WIDTH

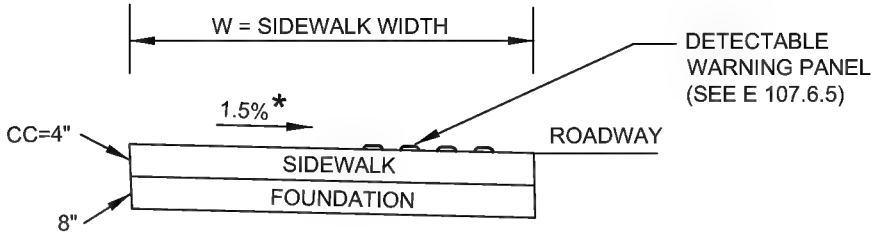
CC = CEMENT CONCRETE

* = TOLERANCE FOR CONSTRUCTION ±0.5%

USABLE SIDEWALK WIDTH PER AAB = W-Wc
USABLE SIDEWALK WIDTH PER AAB IS NOT TO BE LESS THAN 4'0"
SEE E 107.6.5 FOR DETAILS OF DETECTABLE WARNING PANEL

NOTE:

ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO BE ADJUSTED FOR FIELD CONDITIONS



SECTION A-A

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.2.1

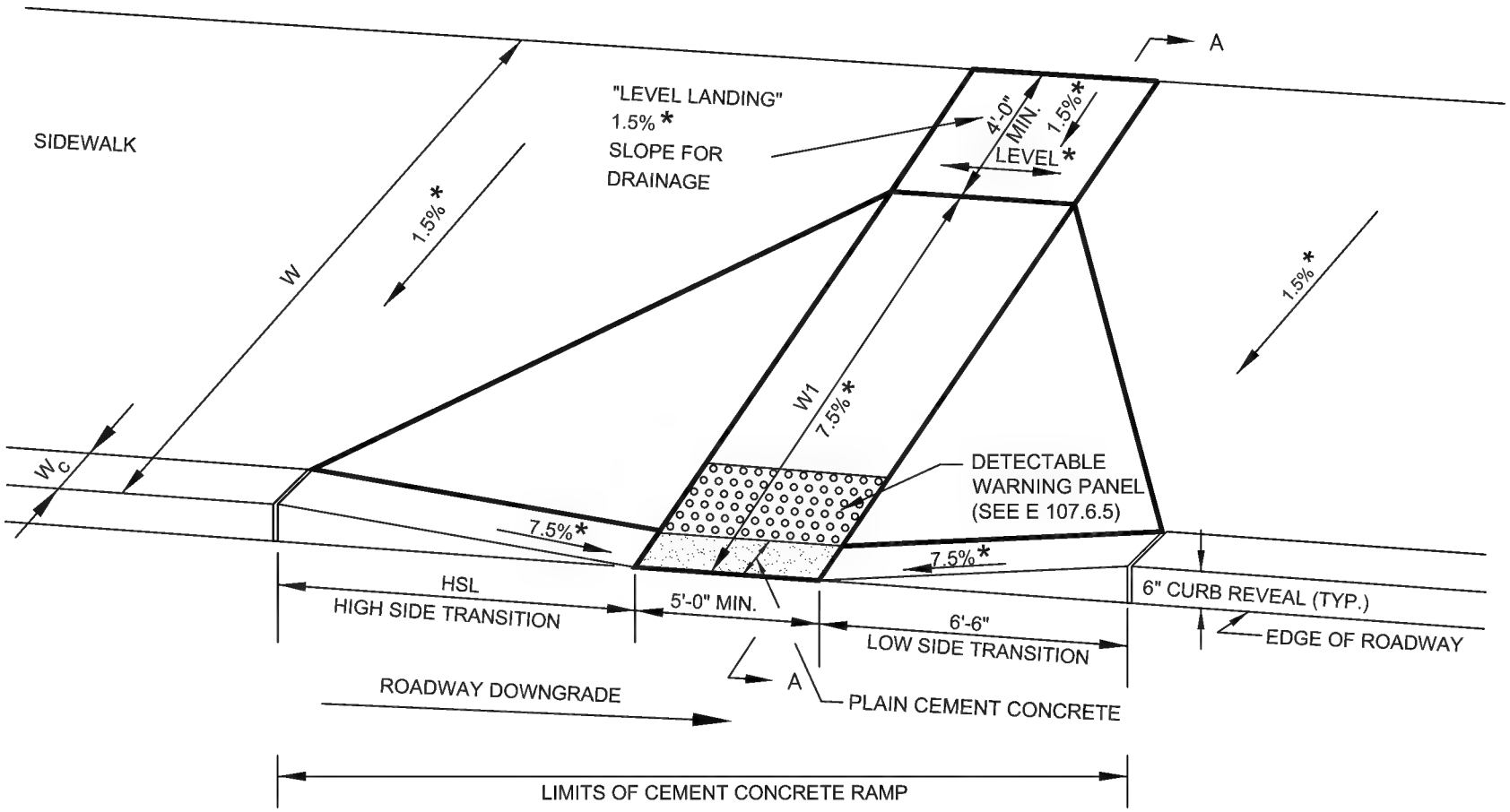
CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

WHEELCHAIR RAMPS
GREATER THAN 12'-4" SIDEWALK

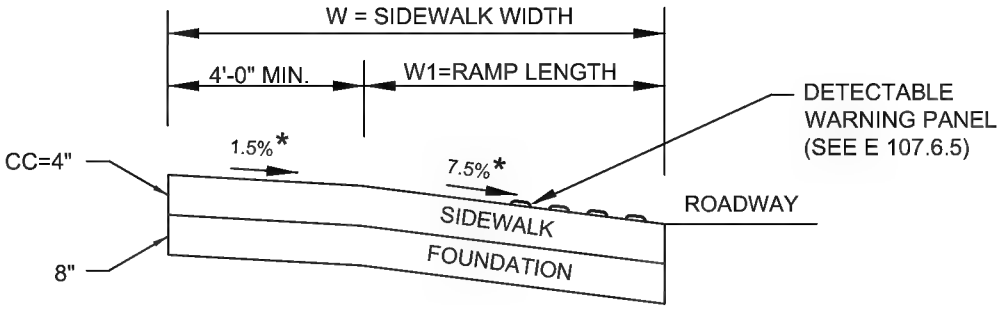
DRAWING NUMBER
E 107.3.0

DATE OF ISSUE
OCTOBER 2017



LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)
W = SIDEWALK WIDTH
W_C = CURB WIDTH
W 1 = PERPENDICULAR RAMP LENGTH
Cc = CEMENT CONCRETE
* = TOLERANCE FOR CONSTRUCTION ±0.5%
USABLE SIDEWALK WIDTH PER AAB = W-Wc
RAMP LENGTH, W1 = W-4'-0" Min

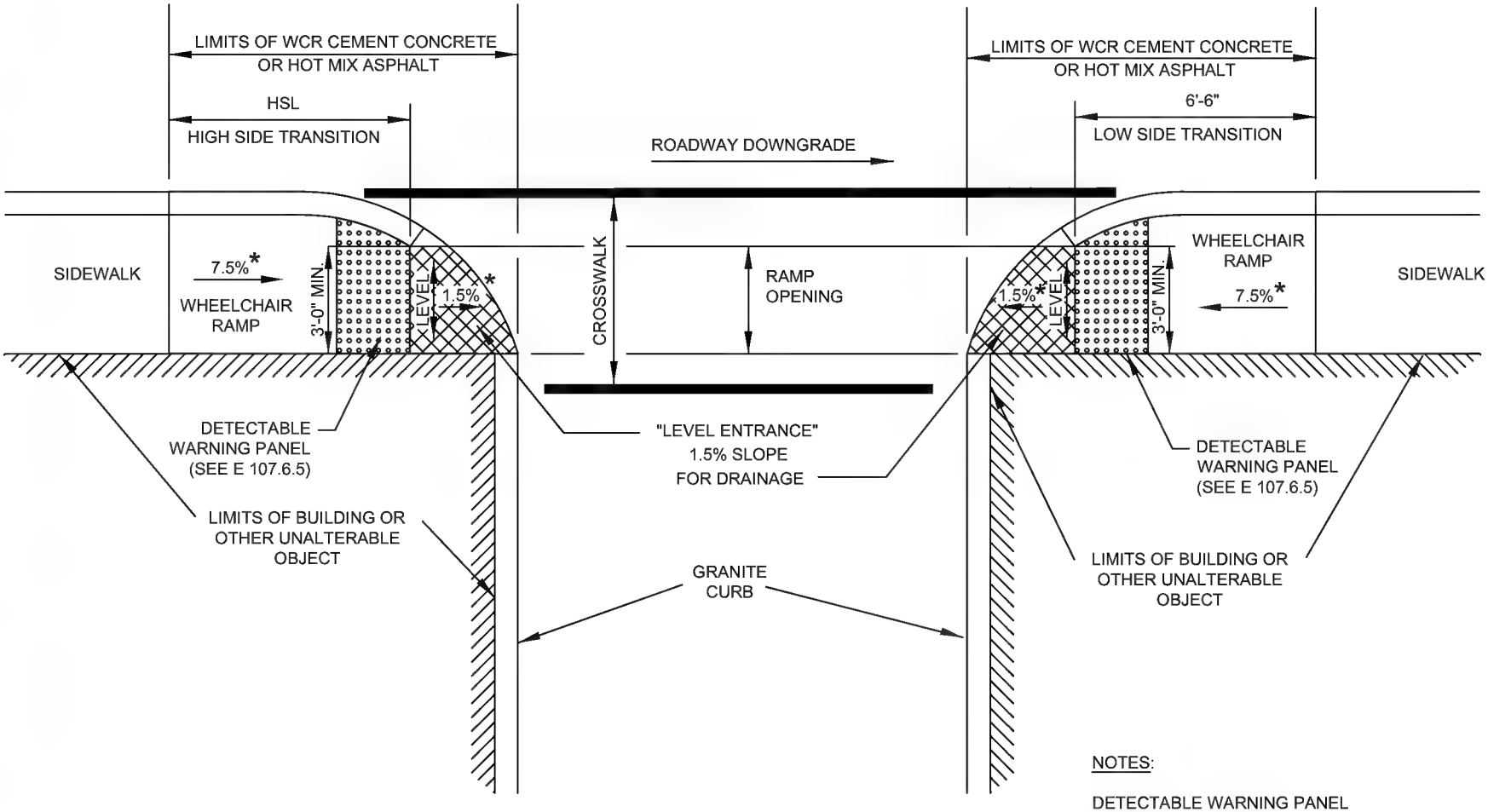


SECTION A-A

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

WHEELCHAIR RAMP FOR ONE CONTINUOUS DIRECTION OF PEDESTRIAN TRAVEL



LEGEND

HSL = HIGH SIDE TRANSITION LENGTH (SEE E 107.9.0)

* = TOLERANCE FOR CONSTRUCTION ±0.5%

NOTES:

DETECTABLE WARNING PANEL LOCATED NOT LESS THAN 6" OR MORE THAN 24" FROM ROADWAY EDGE (GUTTER LINE). TRUNCATED DOMES TO BE ALIGNED WITH DIRECTION OF TRAVEL.

FOR DETAILS OF TRUNCATED DOMES SEE DRAWING E 107.6.5.

ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO BE ADJUSTED FOR FIELD CONDITIONS.

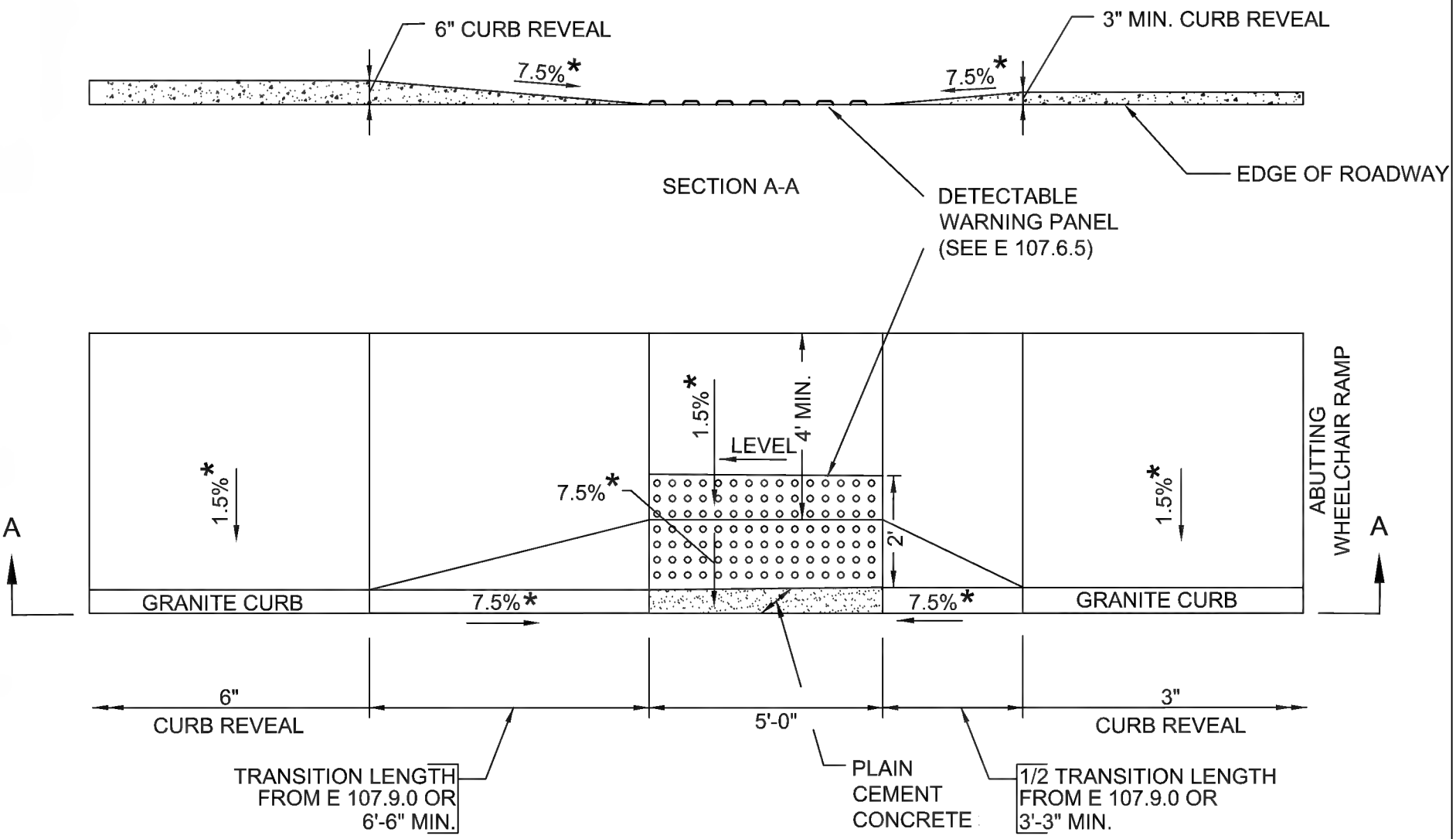
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.6.0

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

WHEELCHAIR RAMP WITH 3" CURB REVEAL



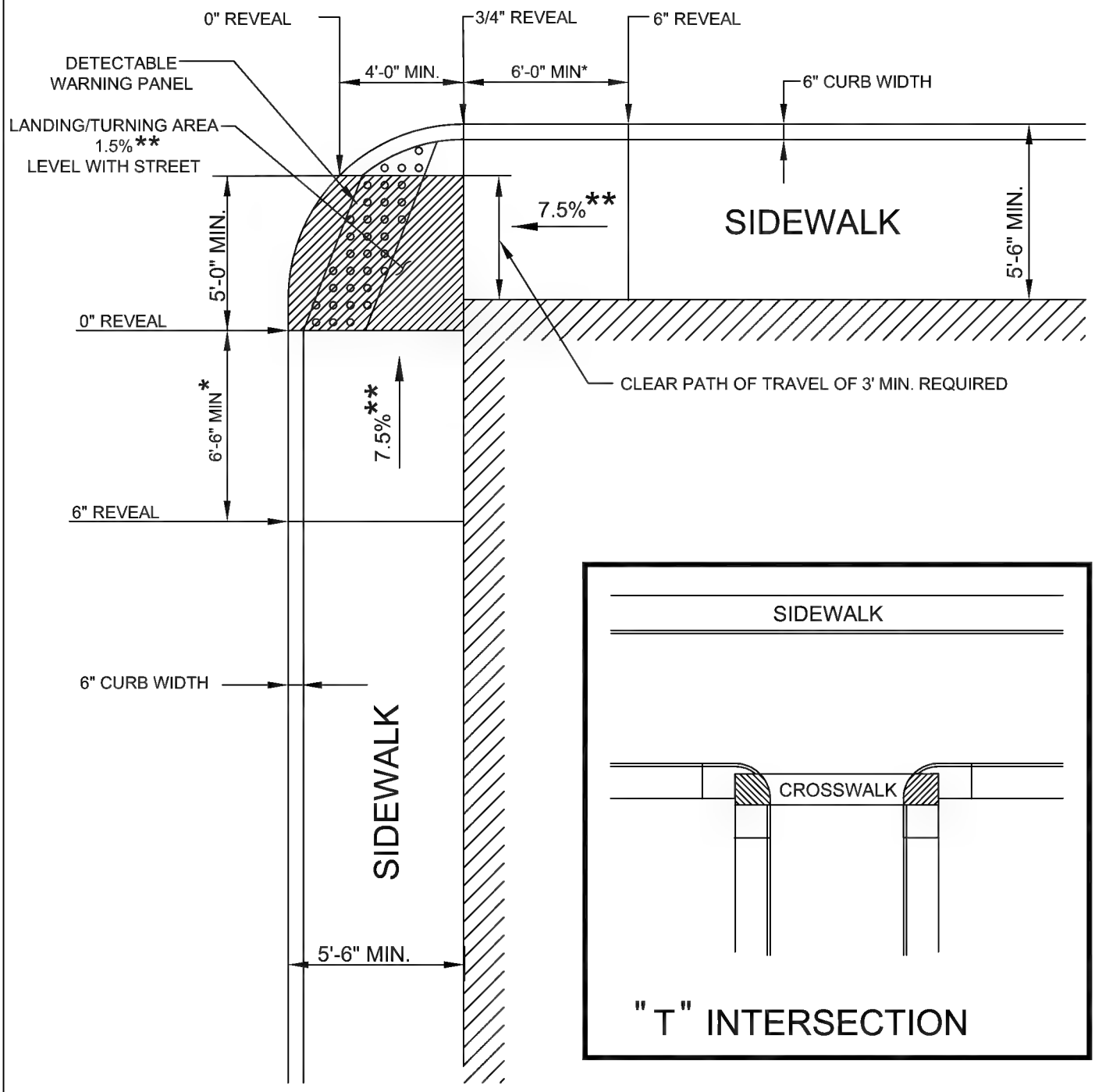
LEGEND

HSL = HIGH SIDE TRANSITION LENGTH
SEE E 107.9.0

* = TOLERANCE FOR CONSTRUCTION ±0.5%

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.6.3



LEGEND

BUILDING OR OTHER UNALTERABLE CONDITION

* TRANSITION LENGTH SHOWN IS MINIMUM. (SEE E 107.9.0)

** TOLERANCE FOR CONSTRUCTION ±0.5%

NOTE:

ROADWAY, GUTTER, AND FIRST 6" OF SIDEWALK TO BE ADJUSTED FOR FIELD CONDITIONS

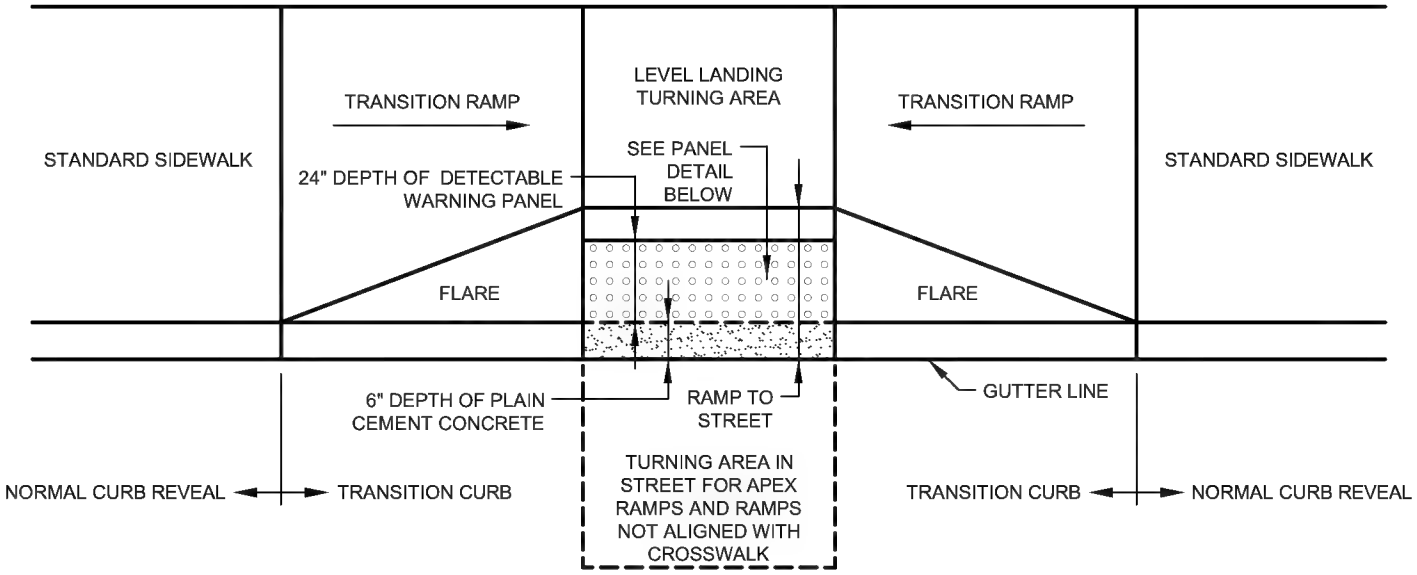
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

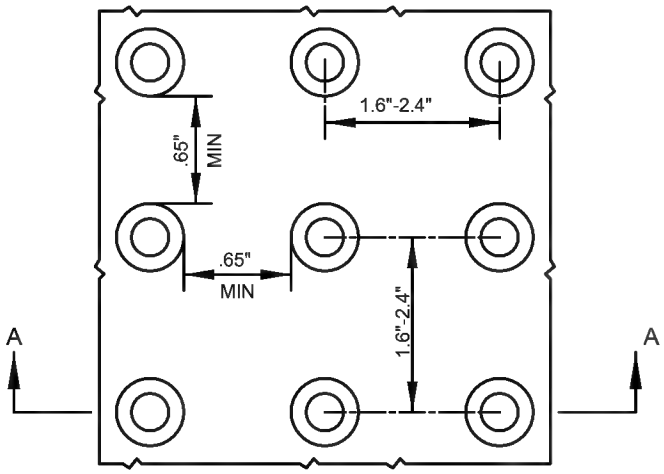
"T" INTERSECTION WHEELCHAIR RAMP

DATE OF ISSUE
OCTOBER 2017

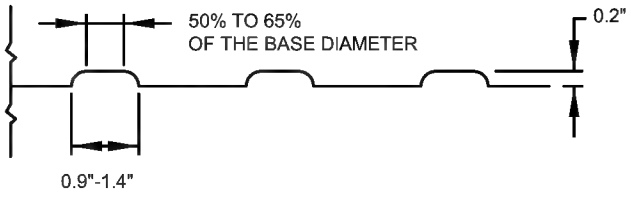
DRAWING NUMBER
E 107.6.4



TYPICAL INSTALLATION



DETAIL OF DETECTABLE WARNING PANEL



SECTION A-A

NOTE:

PANELS MAY BE CONCRETE PRECAST OR CAST IN PLACE OR OTHER SUITABLE MATERIAL PERMANENTLY APPLIED TO THE RAMP. DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH ADJACENT WALKING SURFACES EITHER LIGHT-ON-DARK, OR DARK-ON-LIGHT.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

DETECTABLE WARNING PANEL FOR WHEELCHAIR RAMPS AND STANDARD RAMP TERMINOLOGY

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.6.5

LEGEND

* = TOLERANCE FOR CONSTRUCTION ±0.5%

** = SEE E 107.9.0 FOR TRANSITION LENGTH

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

WHEELCHAIR RAMP WITH LANDSCAPING STRIP

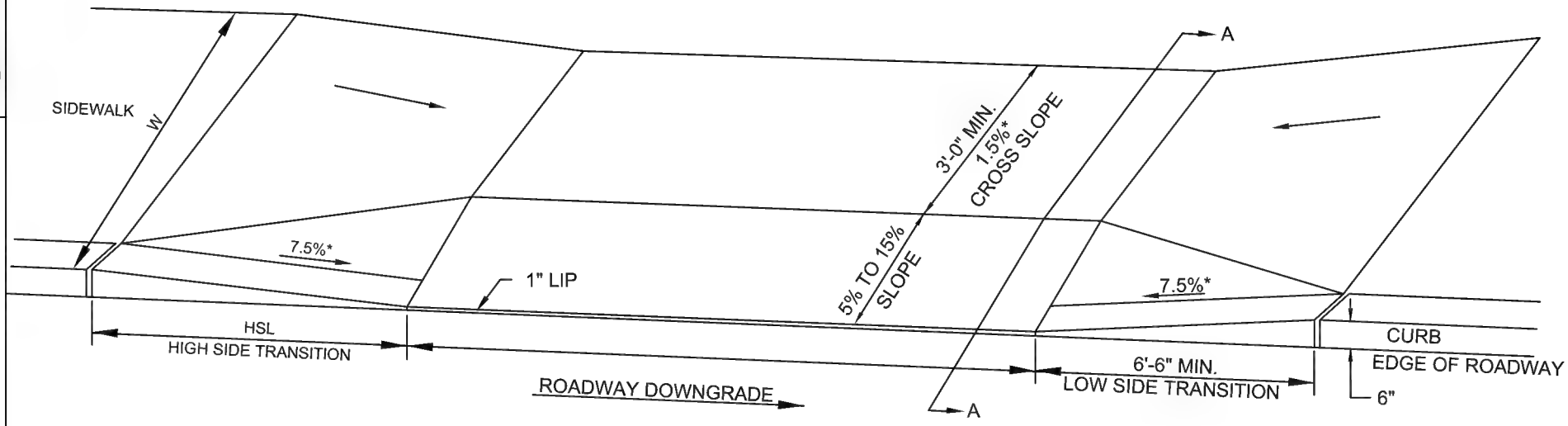
DATE OF ISSUE
OCTOBER 2017

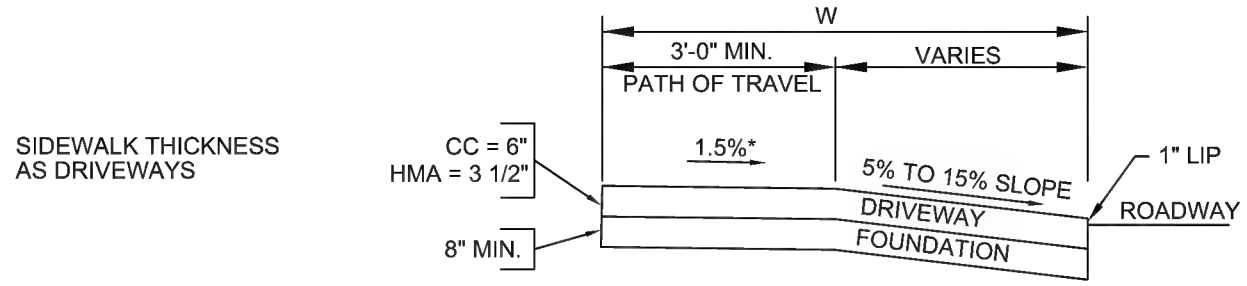
DRAWING NUMBER
E 107.6.9

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

SIDEWALK THROUGH DRIVEWAYS WITHOUT CURB RETURNS





SECTION A-A

LEGEND

HSL = HIGH SIDE TRANSITION LENGTH. SEE E 107.9.0
W = SIDEWALK WIDTH
* = TOLERANCE FOR CONSTRUCTION ±0.5%
CC = CEMENT CONCRETE
HMA = HOT MIX ASPHALT

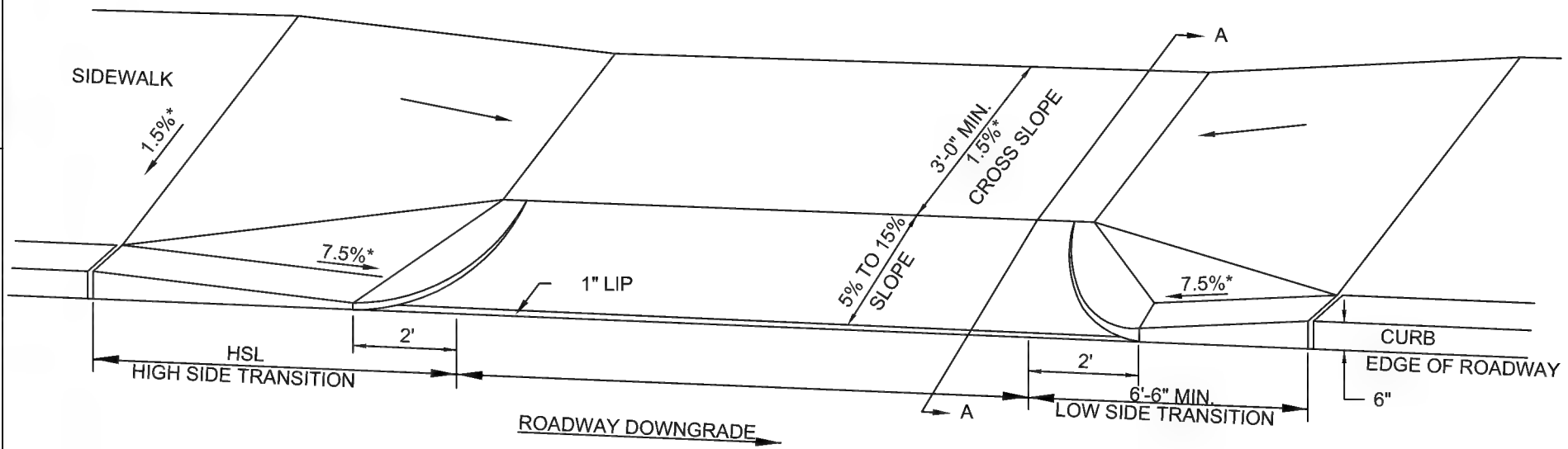
DATE OF ISSUE
OCTOBER 2017

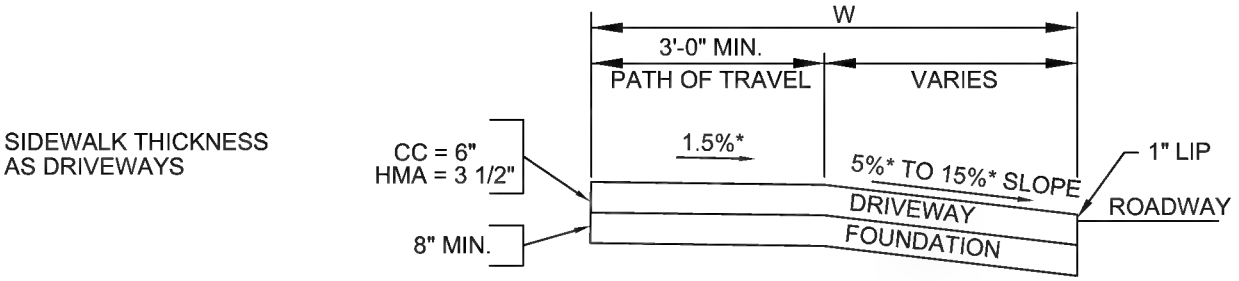
DRAWING NUMBER
E 107.7.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

SIDEWALK THROUGH DRIVEWAYS WITH CURB RETURNS 2' CURB CORNERS





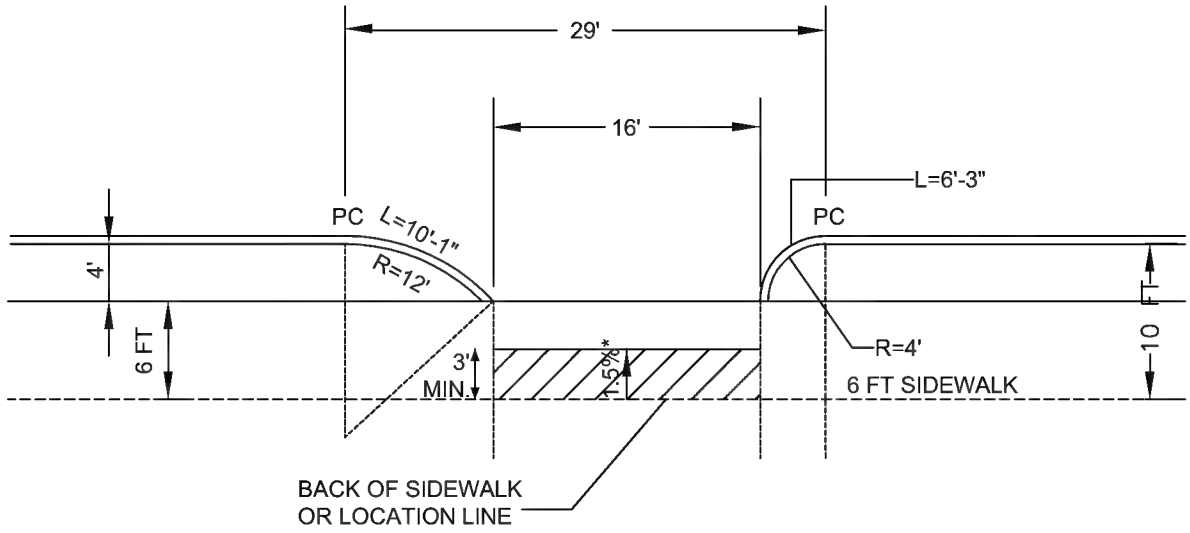
SECTION A-A

LEGEND

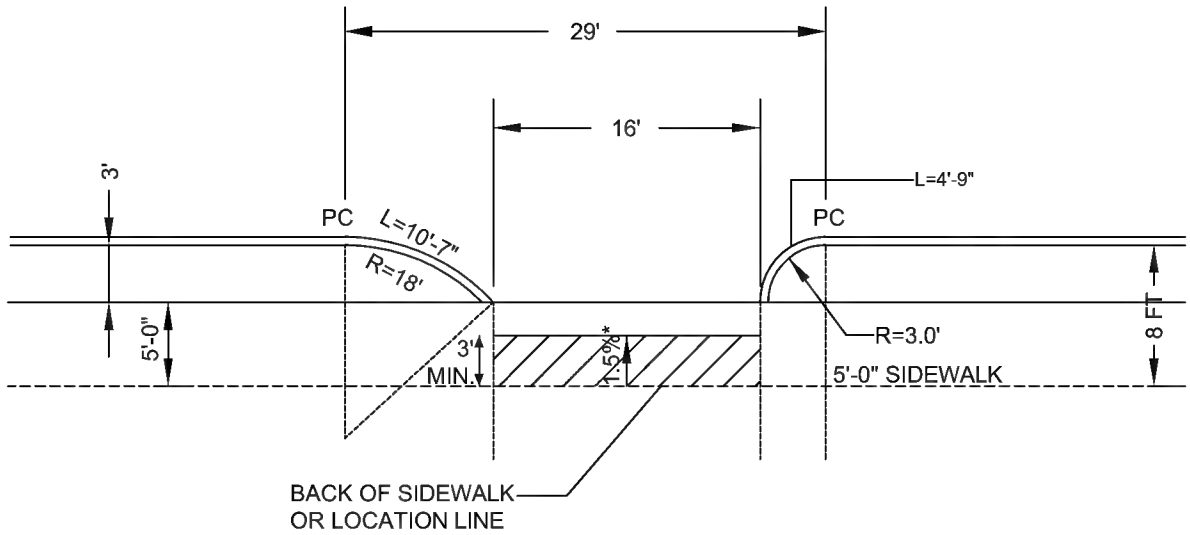
HSL = HIGH SIDE TRANSITION LENGTH. SEE E 107.9.0
W = SIDEWALK WIDTH
* = TOLERANCE FOR CONSTRUCTION ±0.5%
CC = CEMENT CONCRETE
HMA = HOT MIX ASPHALT

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 107.8.0



10 FT SIDEWALK LAYOUT



8 FT SIDEWALK LAYOUT

NOTES:

1. WHEN THE SIDEWALK IS PAVED TO THE CURB LINE, USE SHORT CURB RETURNS AT THE HIGHWAY CURB LINE PC'S, SHOWN IN THESE DESIGNS.

*MUST MAINTAIN PATH OF TRAVEL WITH 1.5% CROSS SLOPE (± 0.5% CONSTRUCTION TOLERANCE)

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS

ROADWAY PROFILE GRADE	* HIGH SIDE TRANSITION LENGTH
%	ENGLISH UNITS
=0%	6'-6"
>0% TO 1%	7'-8"
>1% TO 2%	9'-0"
>2% TO 3%	11'-0"
>3% TO 4%	14'-0"
>4% TO 5%	15'-0" Max

NOTE:

* BASED ON A DESIGN SLOPE OF 7.5% AND A REVEAL OF 6".

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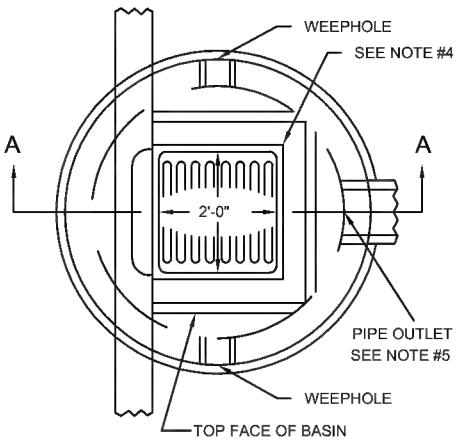
DRAWING NUMBER
E 107.9.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

CONCRETE BLOCK CATCH BASIN

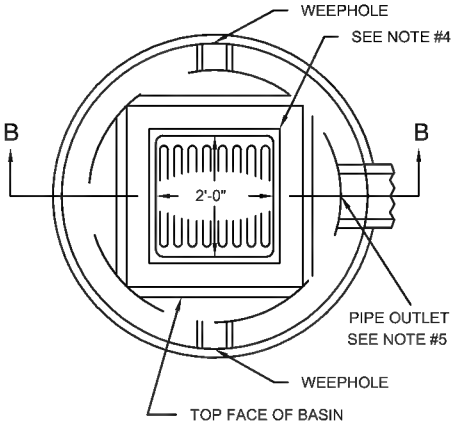


BASIN WITH CURB INLET

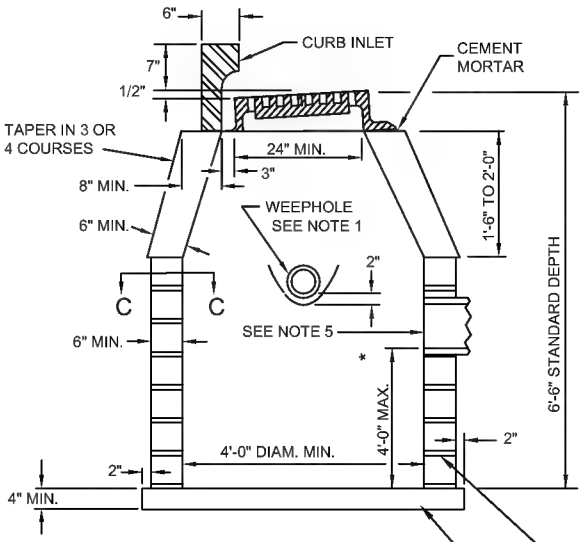
* MINIMUM DEPTH OF SUMP TO BE 2'
STANDARD DEPTH 3'

NOTES:

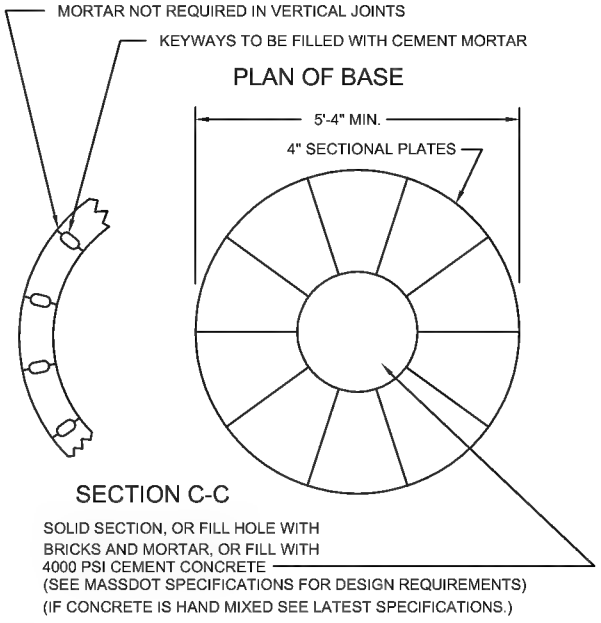
1. WEEPHOLES SHALL BE 4" PIPE OPENING OR EQUIVALENT WITH 1/4 IN. MESH, 23 GAGE GALVANIZED WIRE SCREEN COVERING. 2 CUBIC FEET OF CRUSHED STONE SHALL BE PLACED AROUND EACH WEEPHOLE.
2. BRICKS MAY BE USED BETWEEN TOP COURSE AND C.B. FRAME FOR GRADE ADJUSTMENT. FRAME SHALL BE SET IN FULL BED OF MORTAR.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. DETAILS SHOWN ON DRAWINGS E 201.6.0 - E 201.11.0
5. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4 IN. FROM FACE OF WALL ALONG CENTERLINE OF PIPE.



BASIN WITH 4 FLANGE INLET

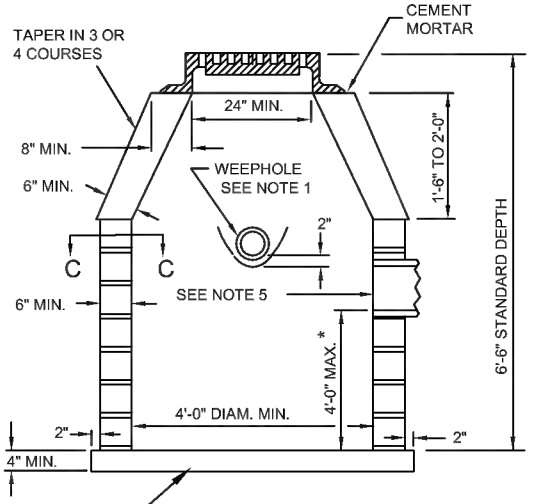


SECTION A-A



SECTION C-C

SOLID SECTION, OR FILL HOLE WITH BRICKS AND MORTAR, OR FILL WITH 4000 PSI CEMENT CONCRETE
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
(IF CONCRETE IS HAND MIXED SEE LATEST SPECIFICATIONS.)



SECTION B-B

BLOCKS TO BE SET IN FULL BED OF CEMENT MORTAR

4000 PSI CEMENT CONCRETE
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
OR PRECAST CONCRETE SECTIONAL PLATES.
SEE ABOVE.

DATE OF ISSUE
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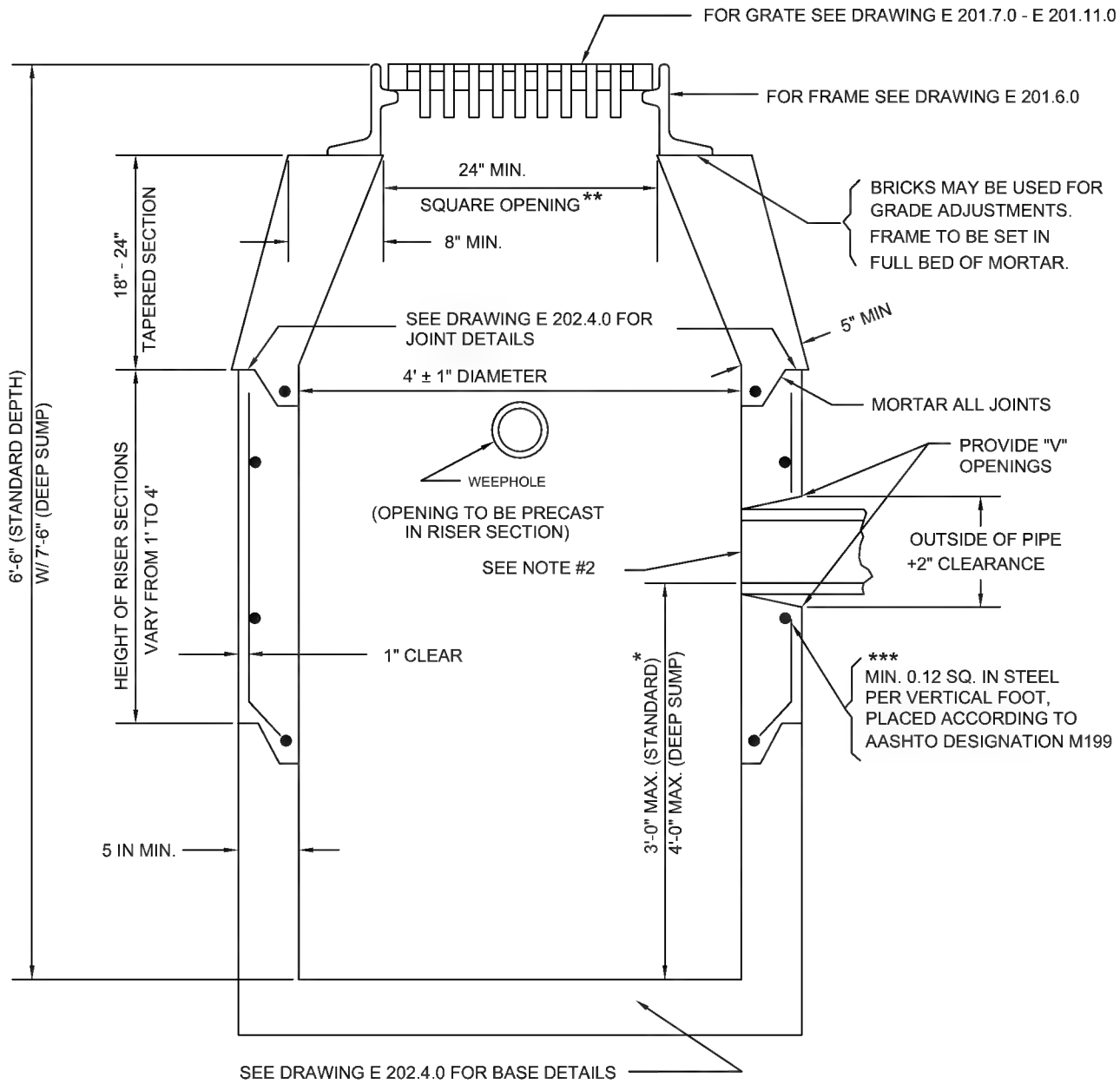
DRAWING NUMBER
E 201.3.0



* MINIMUM DEPTH OF SUMP TO BE 2 FT

** WHEN A CURB INLET IS INSTALLED, THE OPENING IS TO BE 24"±1" X 27"±1"

*** REINFORCING STEEL BASED ON A WALL THICKNESS OF 5".

NOTES:

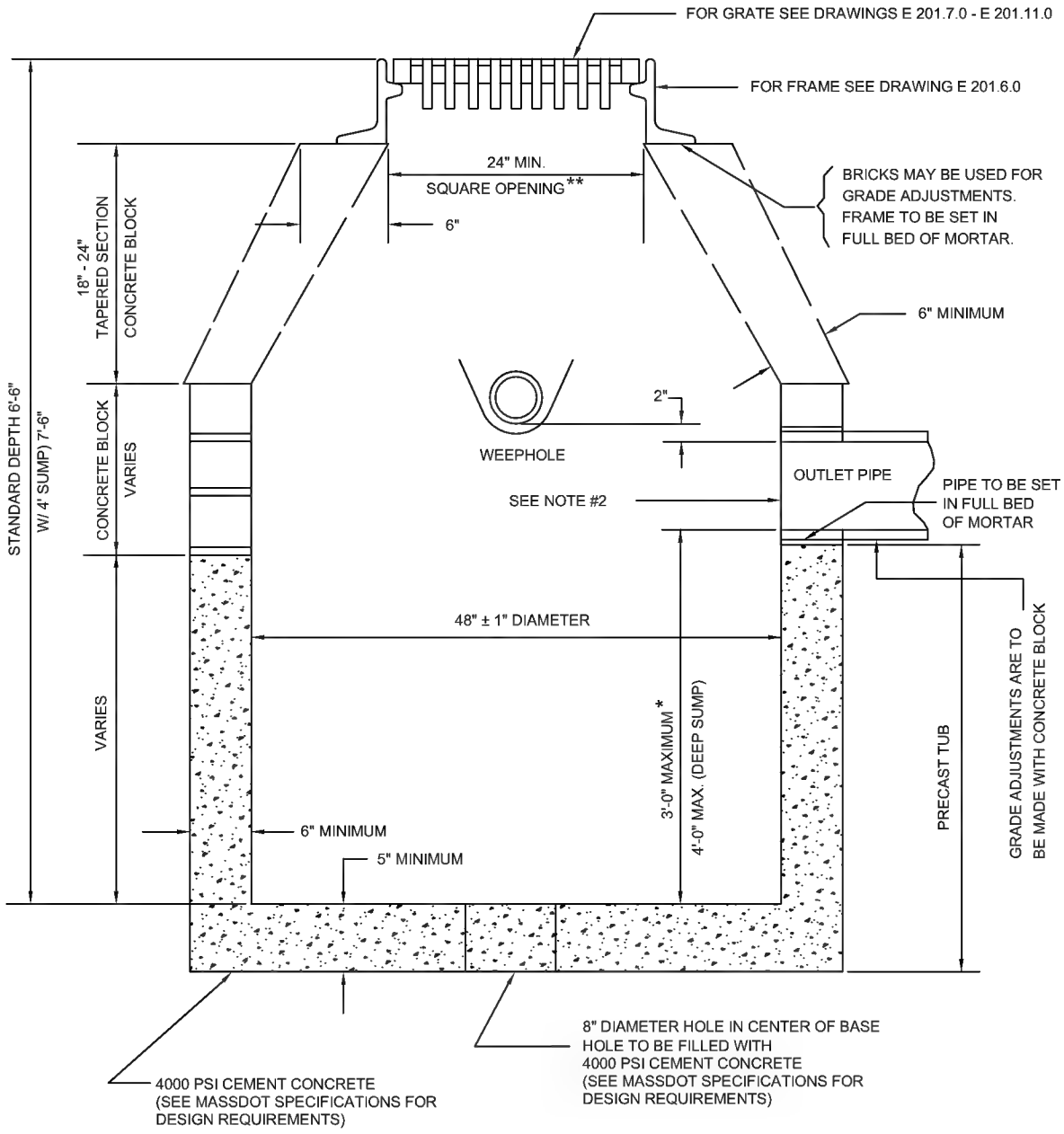
1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON E 201.3.0
2. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL ALONG CENTERLINE OF PIPE.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
4. ALL CONCRETE TO BE AIR ENTRAINED

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

PRECAST CONCRETE CATCH BASIN

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.4.0



* MINIMUM DEPTH OF SUMP TO BE 2'

** WHEN A CURB INLET IS INSTALLED, THE OPENING IS TO BE 24"±1" X 27"±1"

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWING E 201.3.0
2. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL ALONG CENTERLINE OF PIPE.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
4. ALL CONCRETE TO BE AIR ENTRAINED

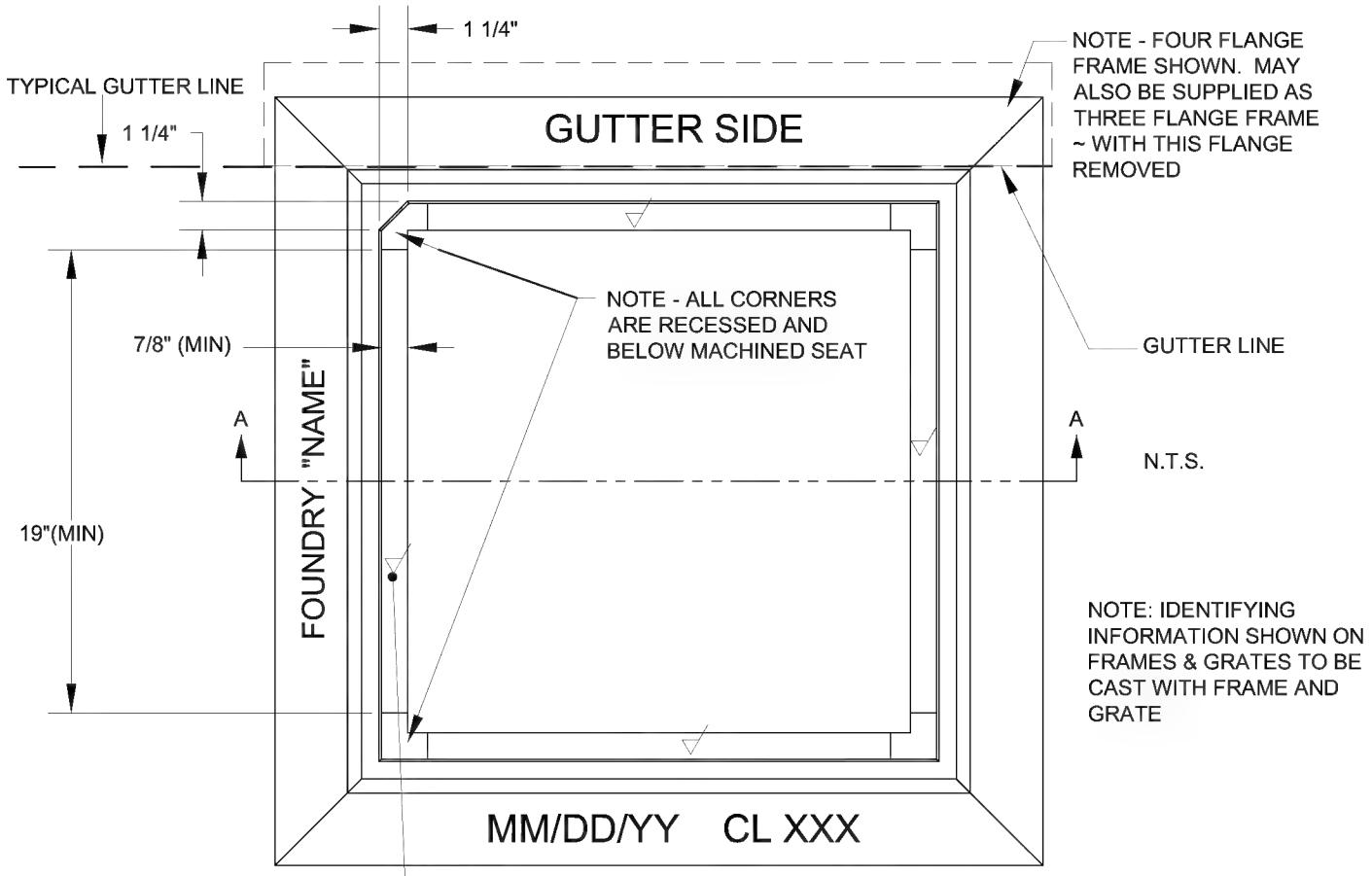
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

PRECAST CONCRETE CATCH BASIN TUB

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.5.0

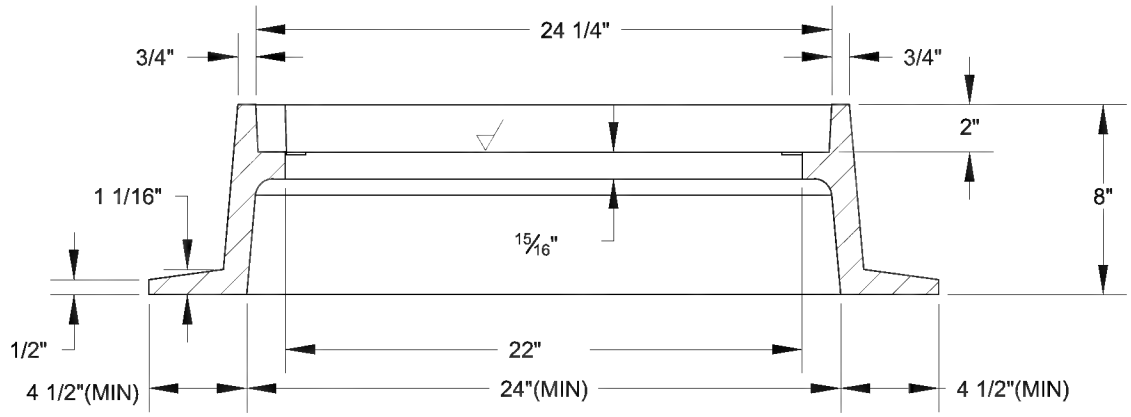


NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE

MACHINE TOLERANCES:

▽ MACHINED SEATS (4) REQUIRED FLAT AND IN PLANE WITHIN .010" TOTAL INDICATOR READING

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



WEIGHTS:

3-FLANGE FRAME	240 LBS. MIN
4-FLANGE FRAME	270 LBS. MIN

AASHTO HS 20 LOAD RATED

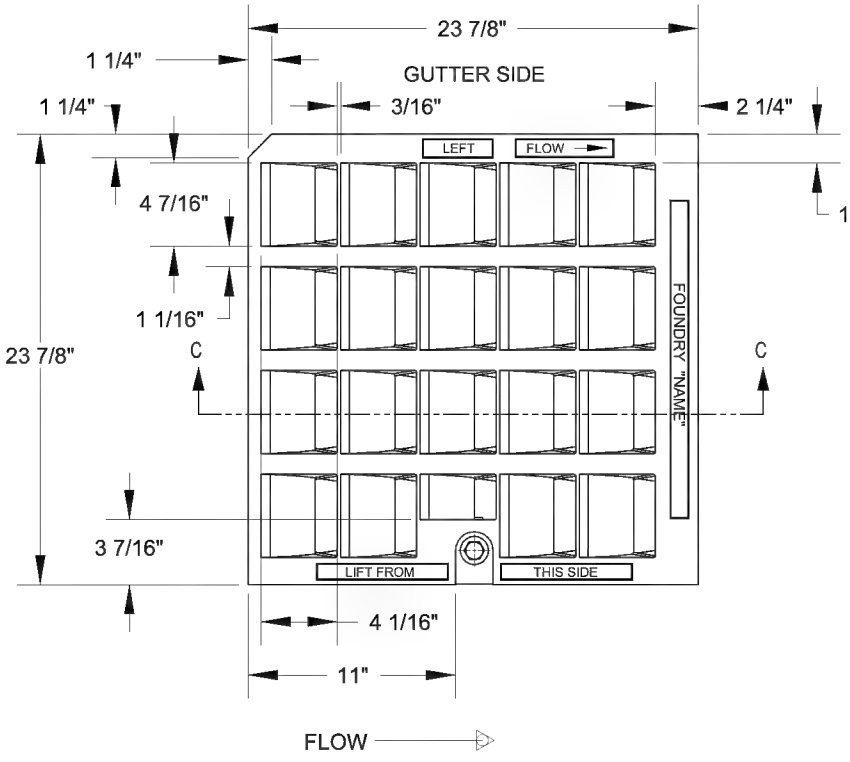
CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

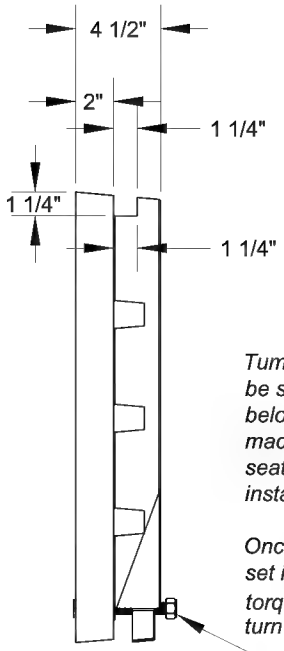
CATCH BASIN FRAME

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.6.0



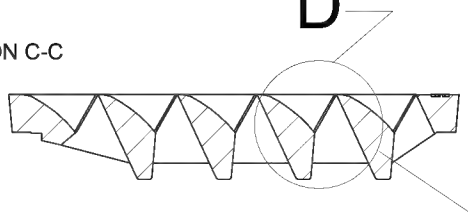
END VIEW N.T.S.



Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt ¼ turn past snug.

SECTION C-C

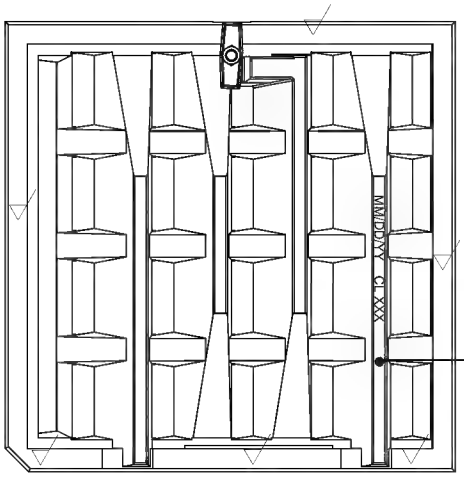


LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST.STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304

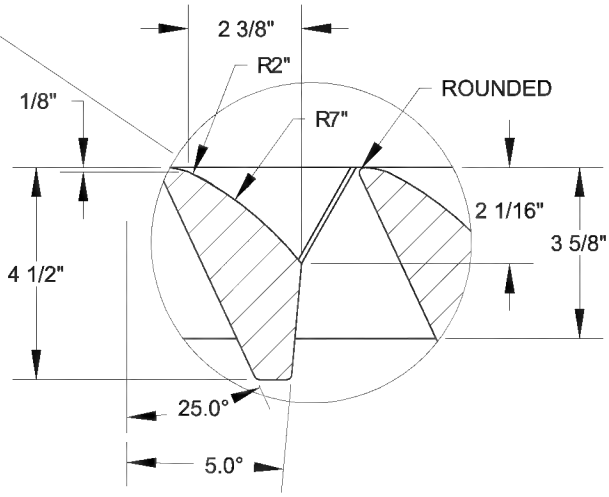
CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED



CAST BACK FACE WITH MOLD DATE AND PART NO.

WEIGHT: 265 LBS. MIN
AASHTO HS 20 PROOF LOAD

NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE



Machine tolerances:

Surfaces noted ▽ must be machined flat and in-plane within .010" Total Indicator Reading

CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

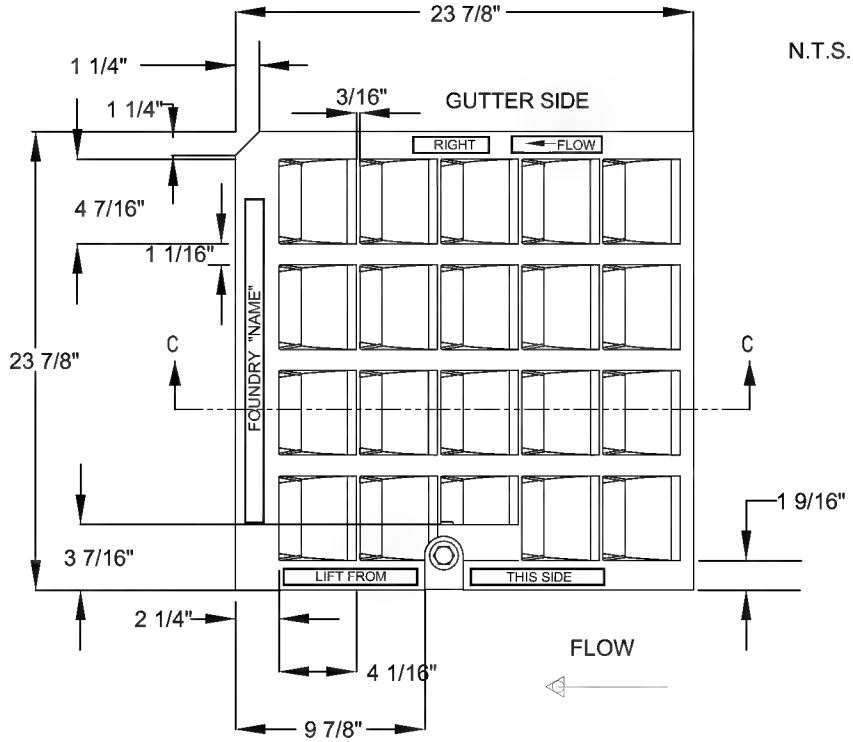
NOTE: CASCADE GRATE ONLY TO BE USED ON FACILITIES WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

HOOK LOCK CASCADE GRATE FLOW FROM LEFT

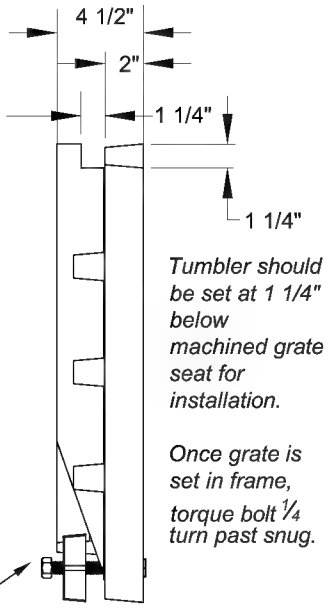
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.7.0



N.T.S.

END VIEW



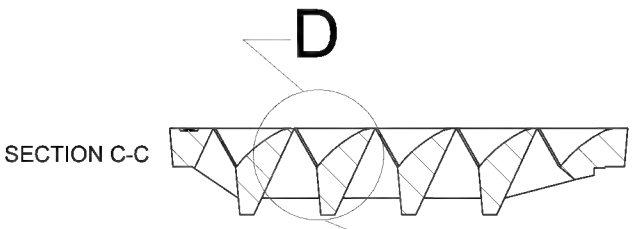
Tumbler should be set at 1 1/4" below machined grate seat for installation.

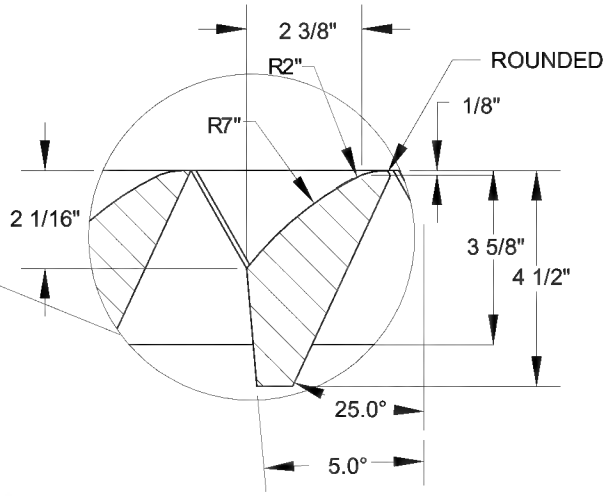
Once grate is set in frame, torque bolt ¼ turn past snug.

LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

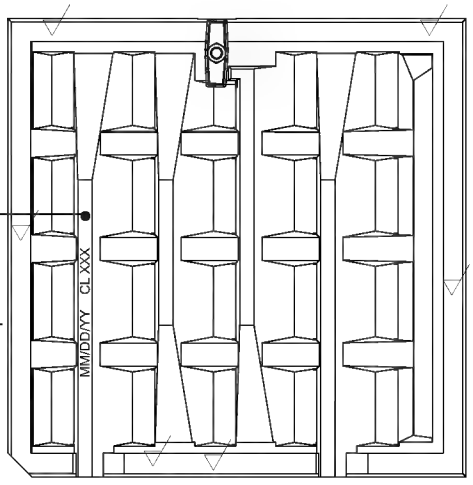
5/8" x 5" ST. STL. BOLT
5/8" ST.STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304





WEIGHT: 265 LBS. MIN
AASHTO HS 20 PROOF LOAD



CAST BACK FACE WITH MOLD DATE AND PART NO.

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

Machine tolerances:

Surfaces noted ▽ must be machined flat and in-plane within .010" Total Indicator Reading

NOTE: CASCADE GRATE ONLY TO BE USED ON FACILITIES WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED.

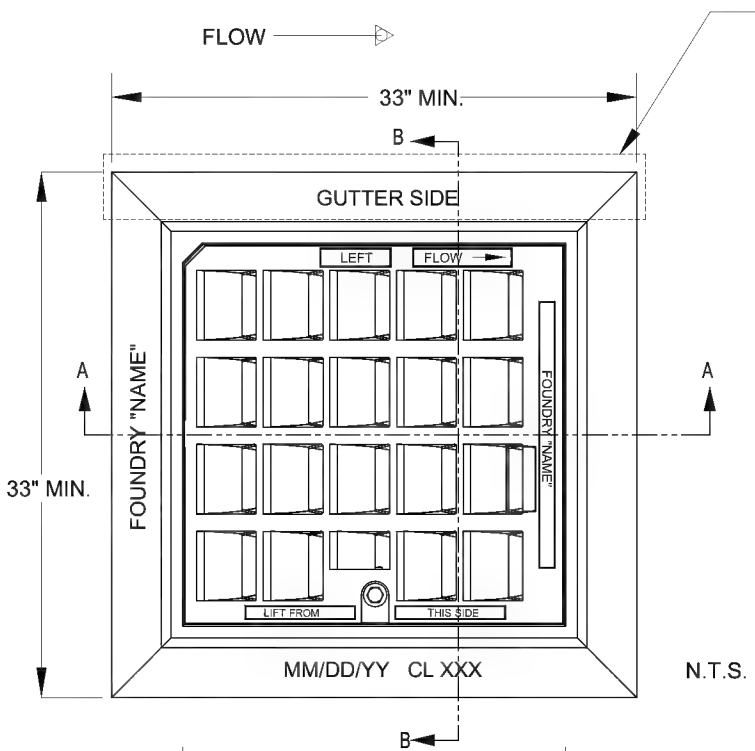
NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

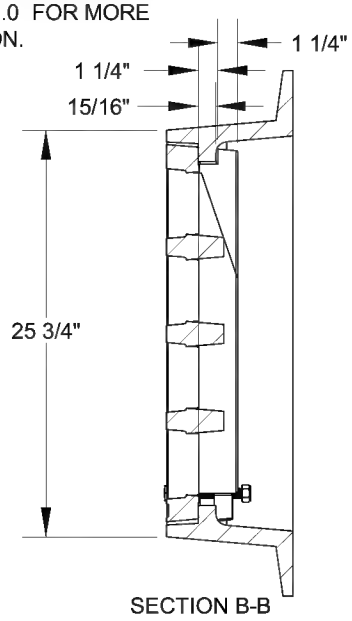
HOOK LOCK CASCADE GRATE FLOW FROM RIGHT

DATE OF ISSUE
OCTOBER 2017

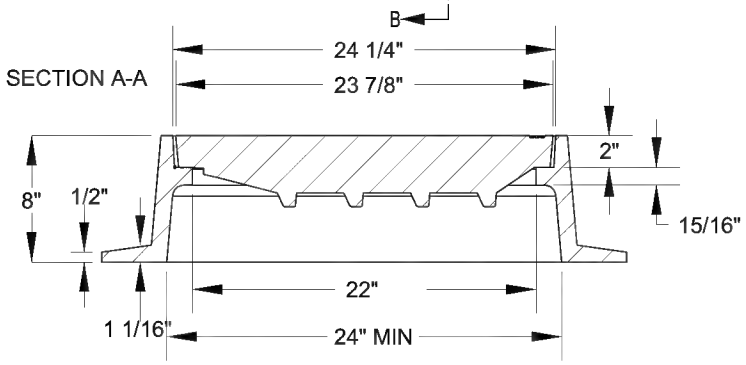
DRAWING NUMBER
E 201.7.1



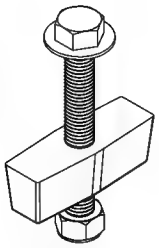
FRAME MAY BE INSTALLED WITH THIS FLANGE REMOVED FOR CURB INLET. FOUR FLANGE IS SHOWN. ~ SEE DWG E 201.6.0 FOR MORE INFORMATION.



SECTION B-B



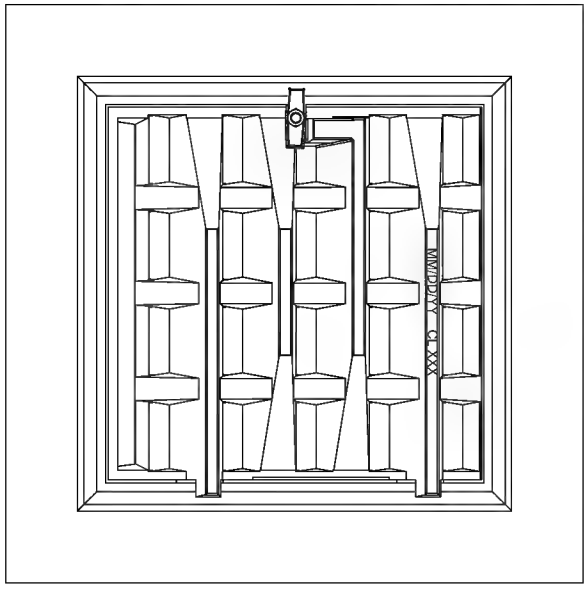
AASHTO HS 20 PROOF LOAD



LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST.STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304



CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt ¼ turn past snug.

WEIGHTS:

3-FLANGE FRAME	240 LBS. MIN
4-FLANGE FRAME	270 LBS. MIN
B-1 GRATE	265 LBS. MIN

NOTE: SEAT SURFACES ON BOTH FRAME AND GRATE ARE MACHINED AND GRATE MUST NOT ROCK IN FRAME WHEN ASSEMBLED.

NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE

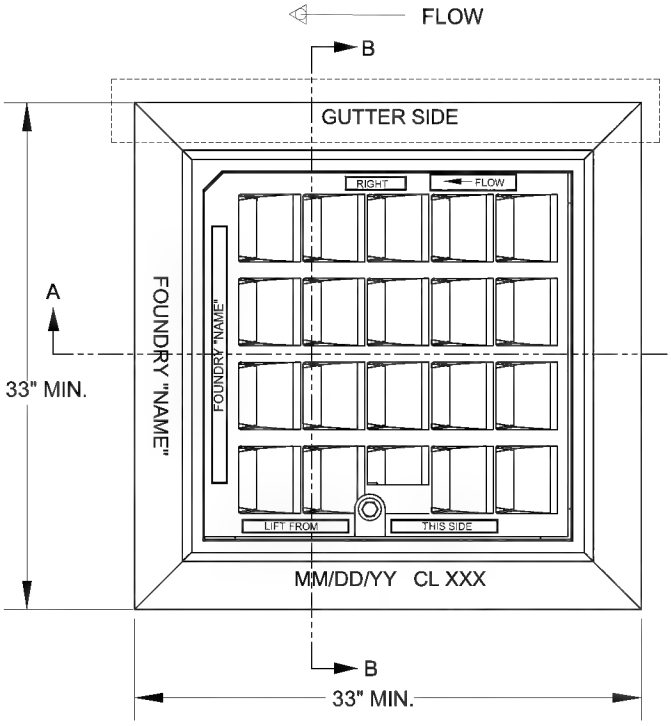
CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

FRAME AND HOOK LOCK CASCADE GRATE - FLOW FROM LEFT ASSEMBLY DETAILS

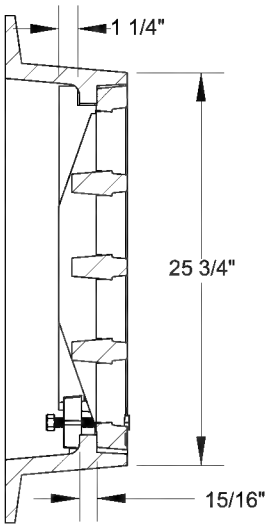
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.9.0



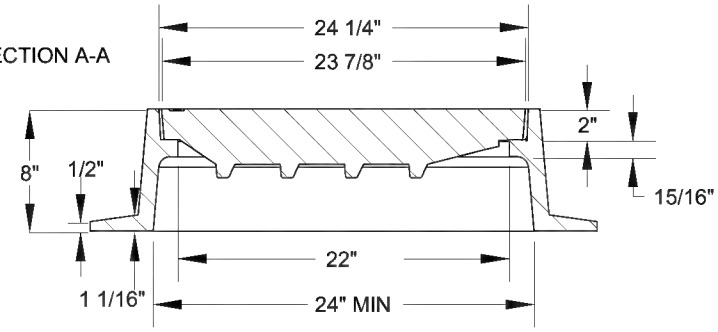
FRAME MAY BE INSTALLED WITH THIS FLANGE REMOVED FOR CURB INLET. FOUR FLANGE IS SHOWN. ~ SEE DWG E 201.6.0 FOR MORE INFORMATION.

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

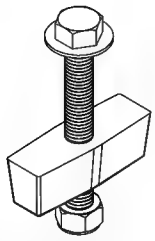


AASHTO HS 20 PROOF LOAD
N.T.S.

SECTION A-A



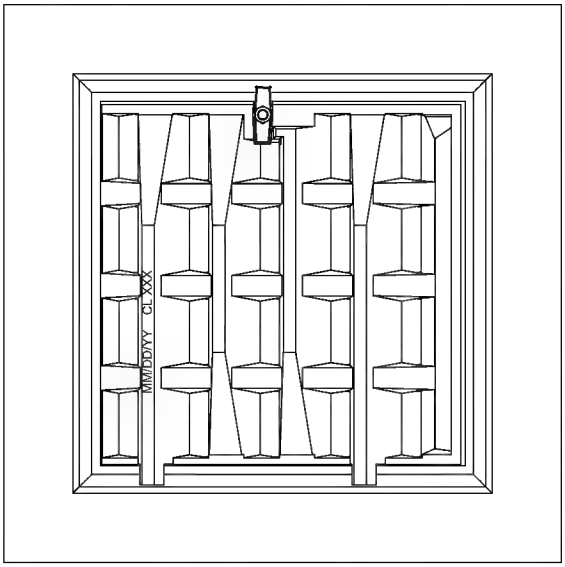
SECTION B-B



LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST.STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304



Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt ¼ turn past snug.

WEIGHTS:

3-FLANGE FRAME	240 LBS. MIN
4-FLANGE FRAME	270 LBS. MIN
B-2 GRATE	265 LBS. MIN

NOTE: SEAT SURFACES ON BOTH FRAME AND GRATE ARE MACHINED AND GRATE MUST NOT ROCK IN FRAME WHEN ASSEMBLED.

CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

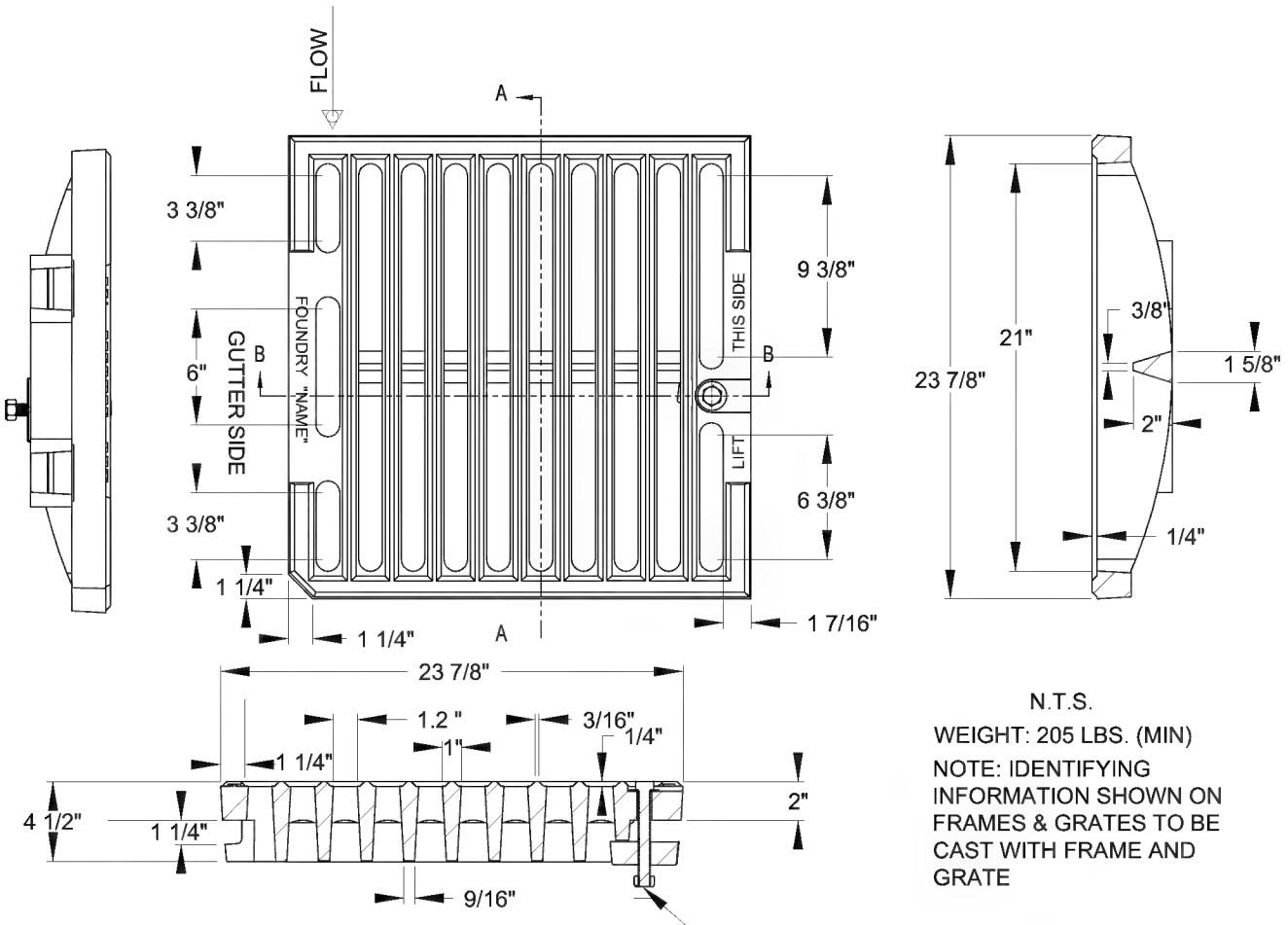
NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

FRAME AND HOOK LOCK CASCADE GRATE - FLOW FROM RIGHT ASSEMBLY DETAILS

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.9.1



N.T.S.

WEIGHT: 205 LBS. (MIN)

NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE

(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST.STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT
STAINLESS STEEL GRADE 304

AASHTO HS 20 PROOF LOAD

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

CASTING TOLERANCES:
SHALL CONFORM TO AASHTO M306

Machine tolerances:

Surfaces noted ▽ must be machined flat and in-plane within .010" Total Indicator Reading

Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt $\frac{1}{4}$ turn past snug.

NOTE: BAR GRATE NOT TO BE USED ON FACILITIES WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED.

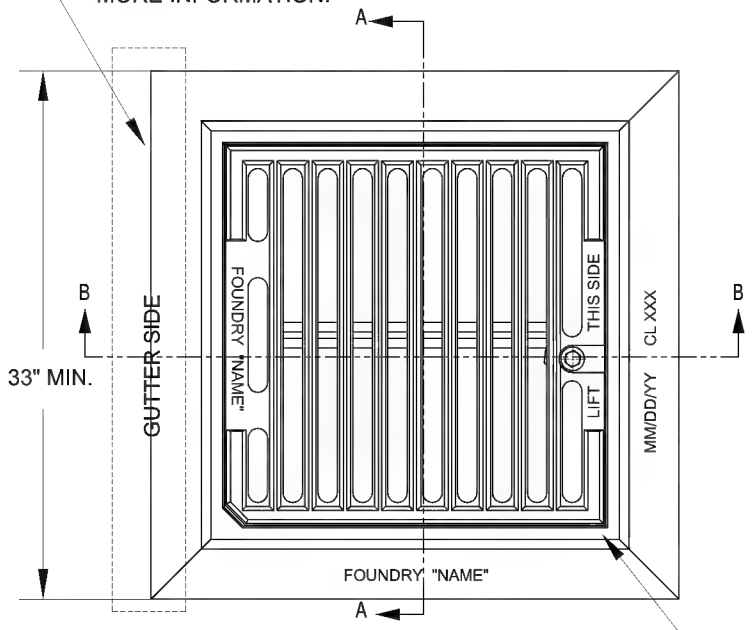
massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

HOOK LOCK BAR GRATE

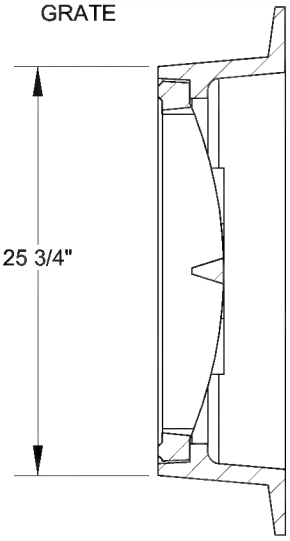
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.10.0

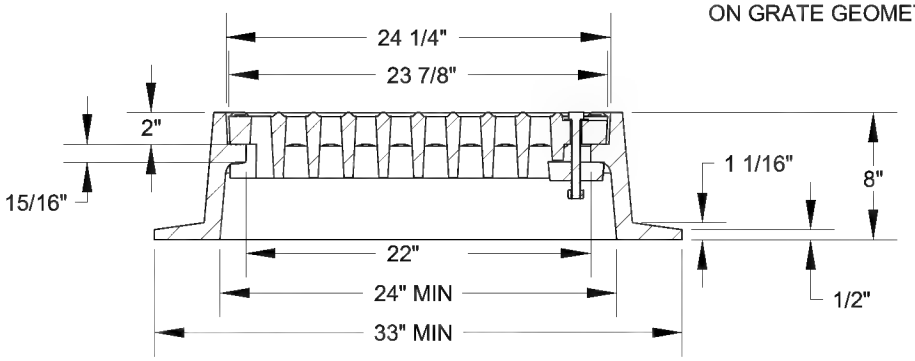
FRAME MAY BE INSTALLED WITH THIS FLANGE REMOVED FOR CURB INLET. FOUR FLANGE IS SHOWN. SEE DWG 201.6.0 R2 FOR MORE INFORMATION.



NOTE: IDENTIFYING INFORMATION SHOWN ON FRAMES & GRATES TO BE CAST WITH FRAME AND GRATE



SEE DWG # FOR MORE INFORMATION ON GRATE GEOMETRY.



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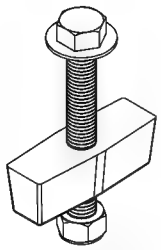
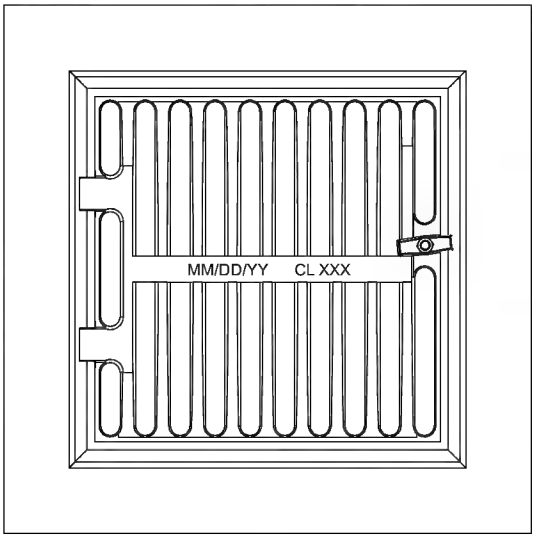


LOCK TUMBLER ASSEMBLY
(1) REQUIRED~CONSISTS OF:

5/8" x 5" ST. STL. BOLT
5/8" ST.STL. FLAT WASHER
CAST IRON TUMBLER
ST. STL. CAPTURE NUT

STAINLESS STEEL GRADE 304

AASHTO HS 20 PROOF LOAD



CASTING TOLERANCES:
SHALL CONFORM TO AAASHTO M306

CLASSIFICATION:
CAST IRON - SEE STANDARD SPECIFICATIONS
WITH NO BLACK ASPHALT COATING ALLOWED

NOTE: SEAT SURFACES ON BOTH FRAME AND GRATE ARE MACHINED AND GRATE MUST NOT ROCK IN FRAME WHEN ASSEMBLED.

Tumbler should be set at 1 1/4" below machined grate seat for installation.

Once grate is set in frame, torque bolt $\frac{1}{4}$ turn past snug.

WEIGHTS:

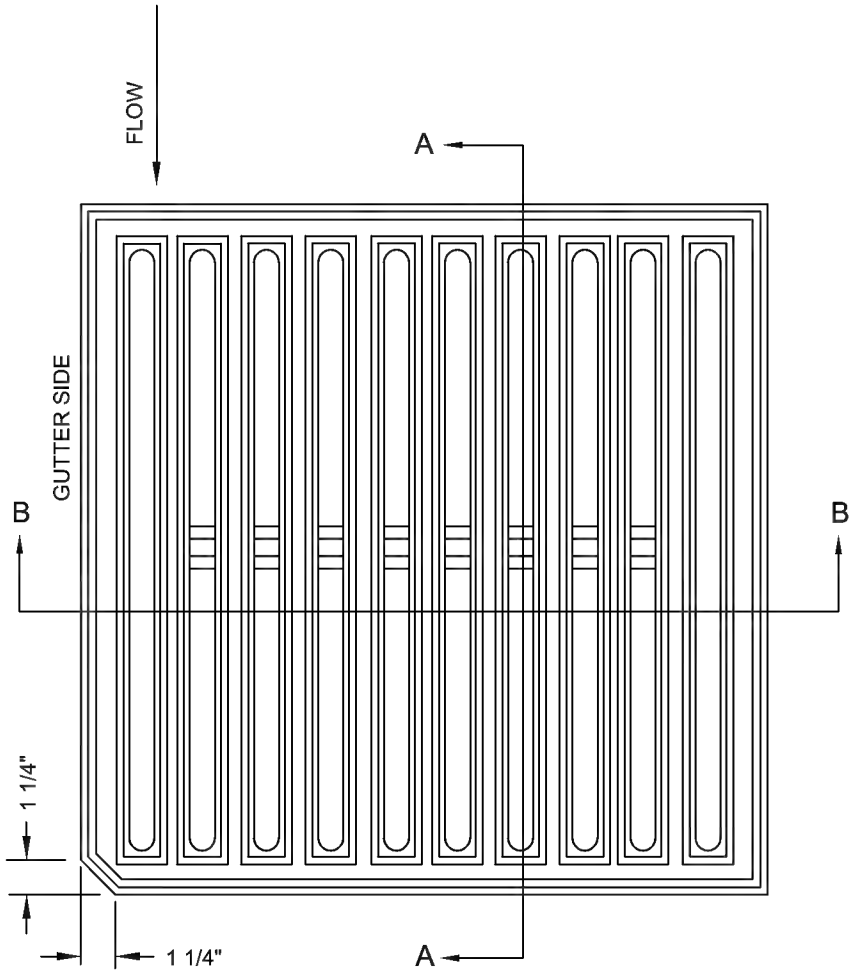
3-FLANGE FRAME	240 LBS. MIN
4-FLANGE FRAME	270 LBS. MIN
A-4 GRATE	205 LBS. MIN

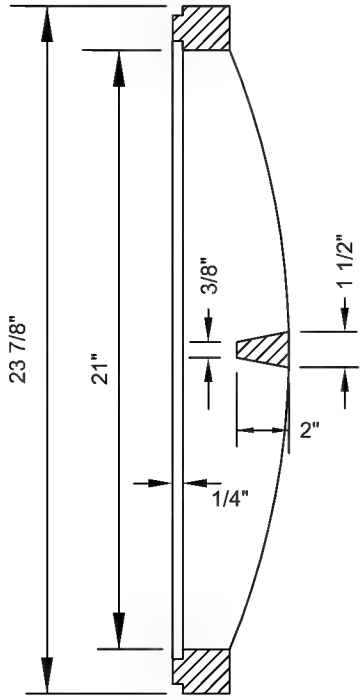
massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

FRAME AND HOOK LOCK BAR GRATE - FRAME ASSEMBLY DETAILS

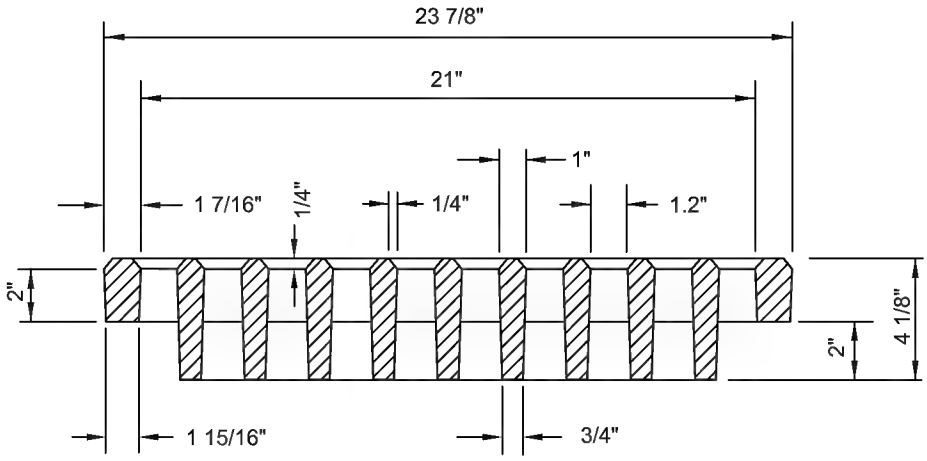
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.10.1





SECTION A-A



SECTION B-B

NOTES:

1. MATERIAL - CAST IRON; SEE STANDARD SPECIFICATIONS
2. MINIMUM MASS - 210 LBS.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

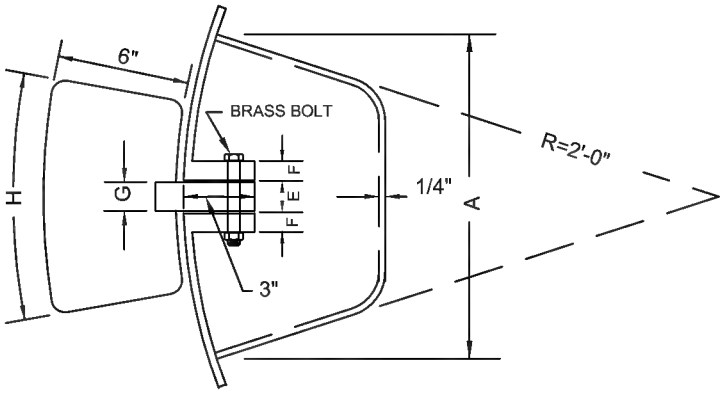
DROP INLET GRATE

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.11.0

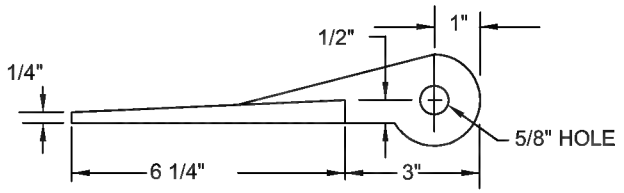
massDOT Highway Division
Massachusetts Department of Transportation
CONSTRUCTION STANDARDS

CATCH BASIN HOOD

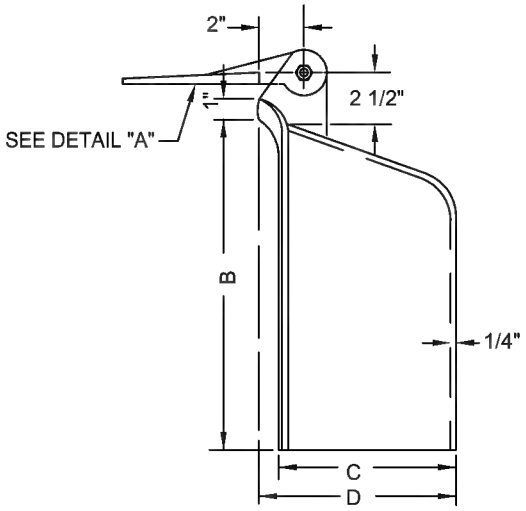


TOP

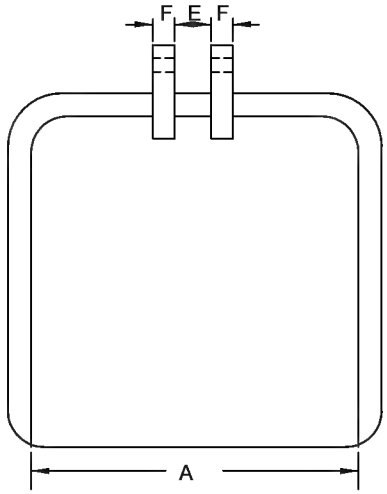
DIMENSIONS (in.)	A	B	C	D	E	F	G	H
8" and 10" PIPE	15	15	8	9	2	7/8	1 7/8	14
12" and 15" PIPE	18	18	10	11 1/4	2	1	1 7/8	14



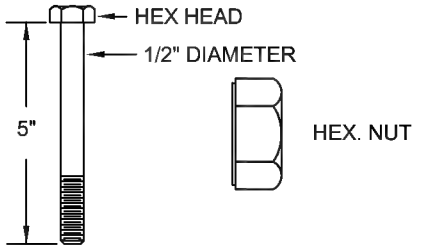
DETAIL "A" HINGE



SIDE



BACK



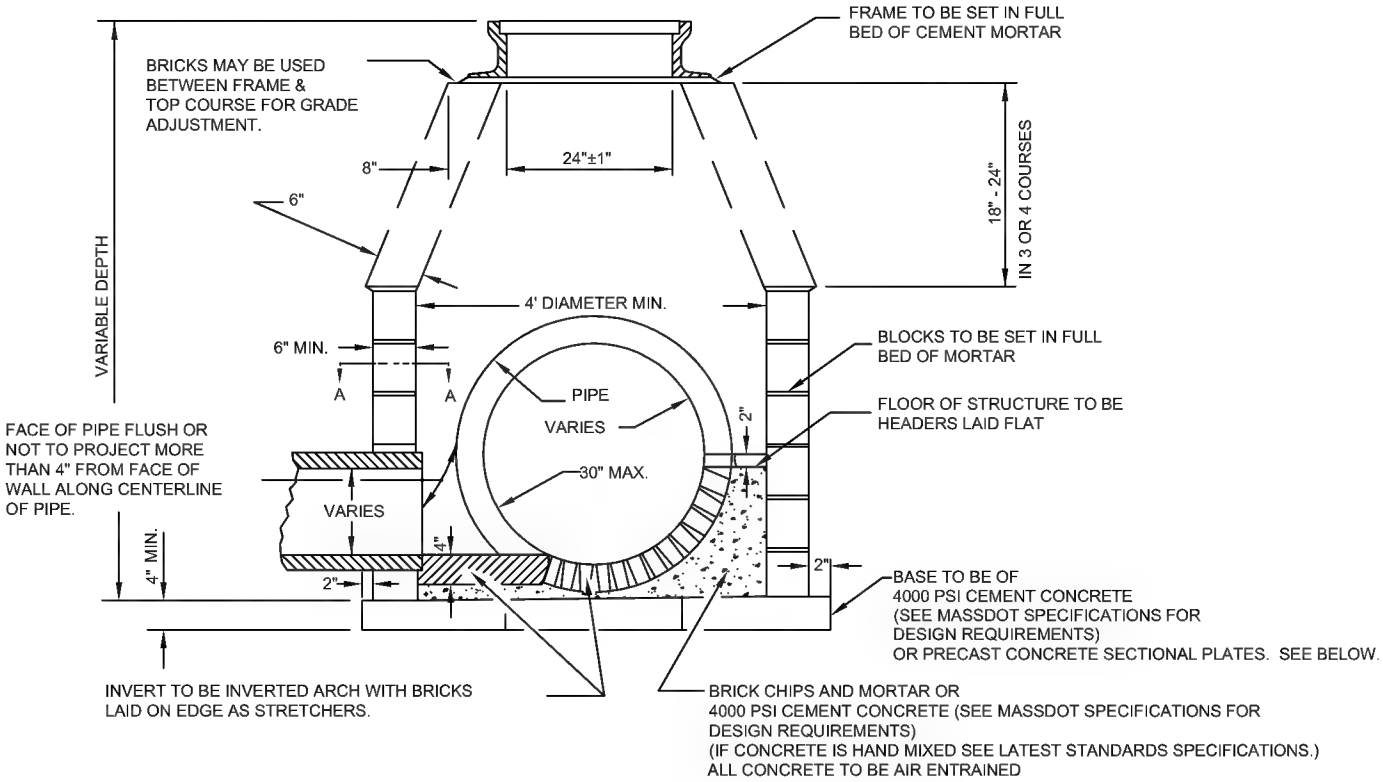
BRASS BOLT & NUT

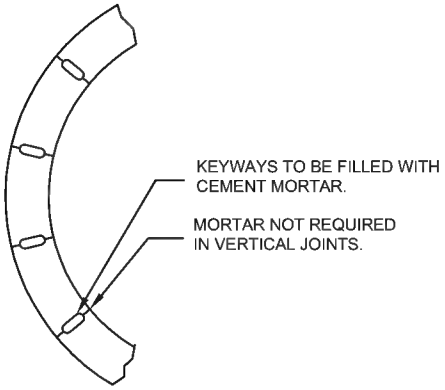
NOTE:

1. HOODS TO BE GRAY CAST IRON - SEE STANDARD SPECIFICATIONS WITH NO BLACK ASPHALT COATING ALLOWED

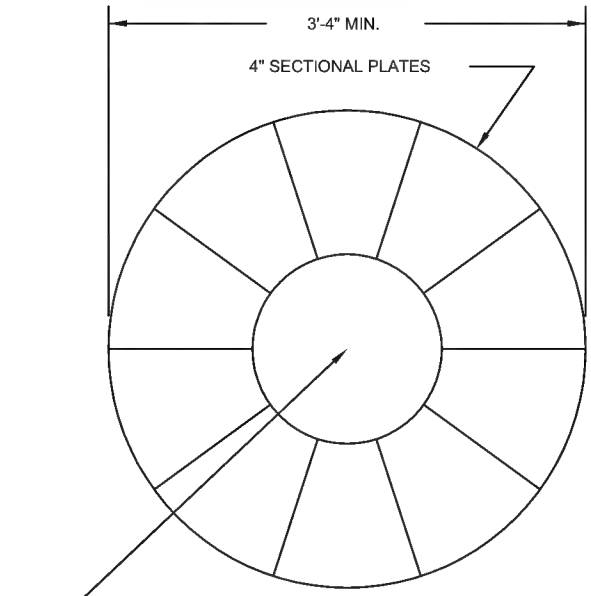
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 201.12.0





SECTION A-A



PLAN OF BASE

SOLID SECTION; OR FILL HOLE WITH BRICKS AND MORTAR;
OR FILL WITH 4000 PSI CEMENT CONCRETE
(SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
(IF CONCRETE IS HAND MIXED SEE LATEST STANDARD SPECIFICATIONS)

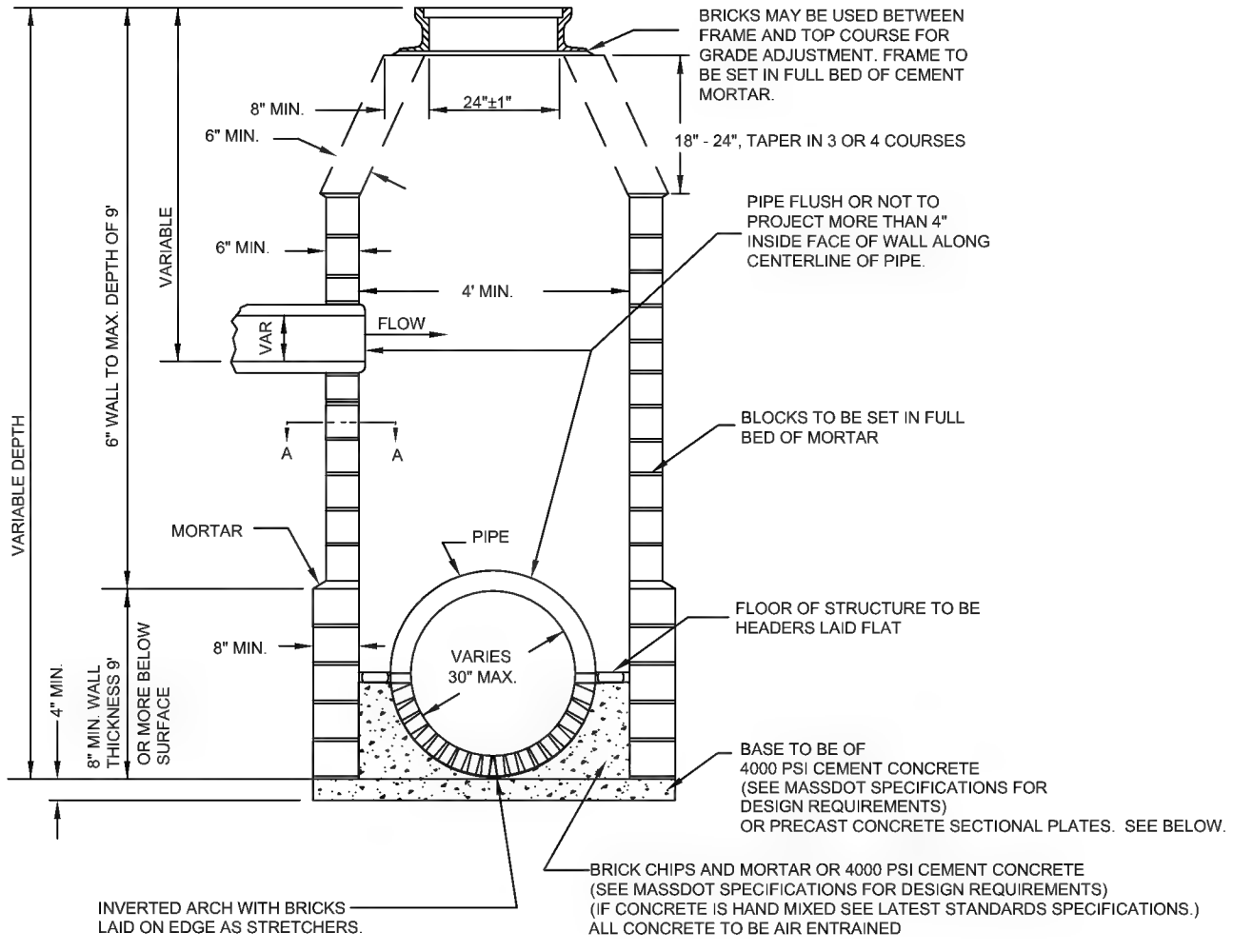
NOTE:
1. DESIGN SHOWN IS FOR MANHOLE OF 9' OR LESS AND PIPE DIAMETER OF 30" OR LESS.
2. STANDARD MANHOLE DEPTH TO BE 6'-6" OR LESS

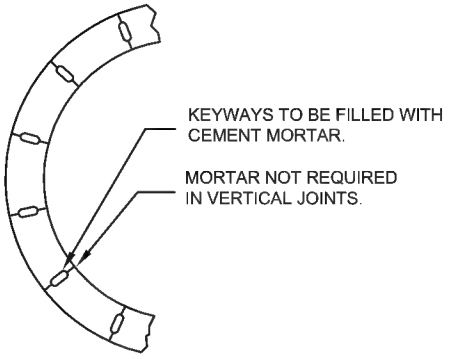
massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

CONCRETE BLOCK MANHOLE
MANHOLES 9' OR LESS IN DEPTH

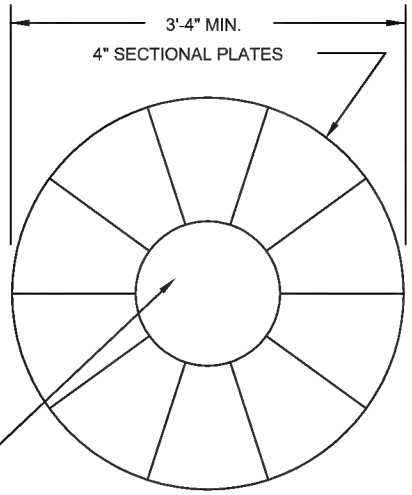
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.2.0





SECTION A-A



PLAN OF BASE

SOLID SECTION; OR FILL HOLE WITH BRICKS AND MORTAR; OR FILL WITH 4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS) (IF CONCRETE IS HAND MIXED SEE LATEST STANDARD SPECIFICATIONS)

NOTE:

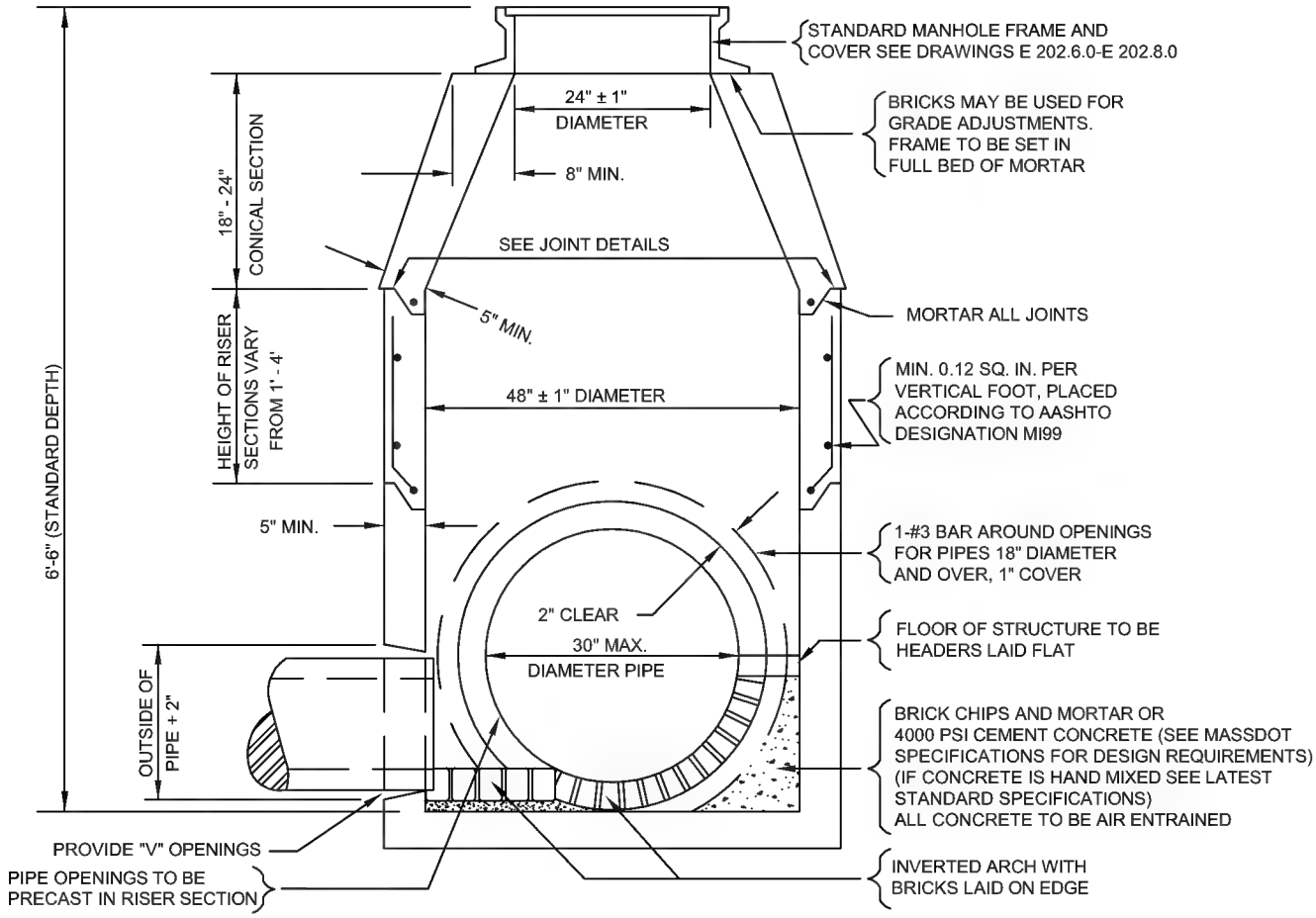
1. MANHOLE DESIGN IS FOR PIPE DIAMETER OF 30" OR LESS

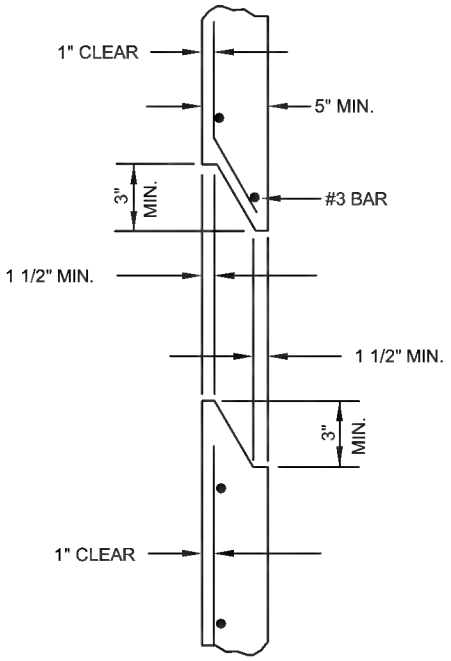
massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

CONCRETE BLOCK MANHOLE MANHOLES OVER 9' IN DEPTH

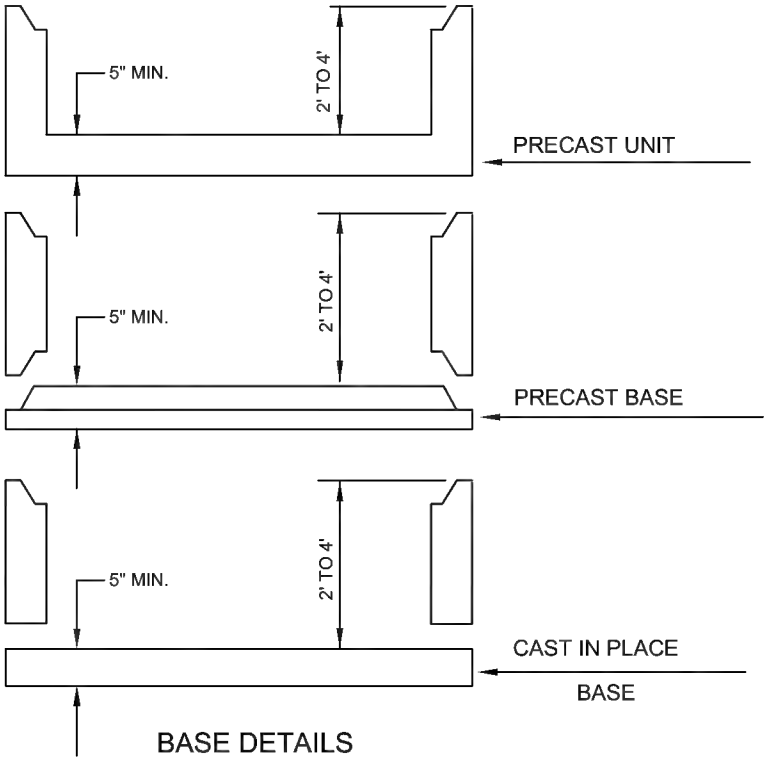
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.3.0





JOINT DETAILS



BASE DETAILS

NOTE:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

PRECAST CONCRETE MANHOLES 9' OR LESS IN DEPTH

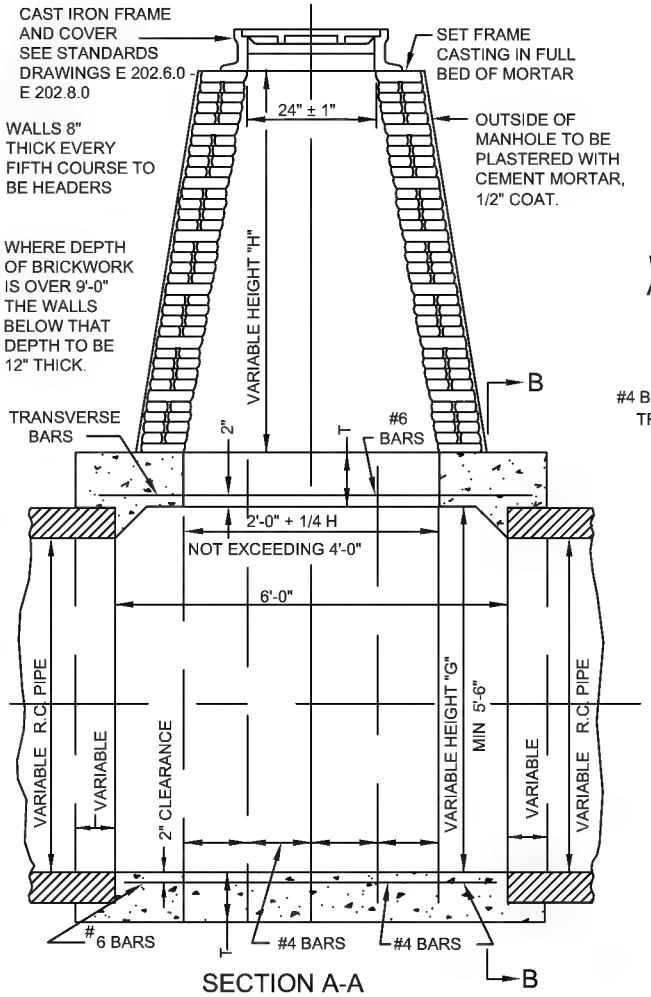
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.4.0

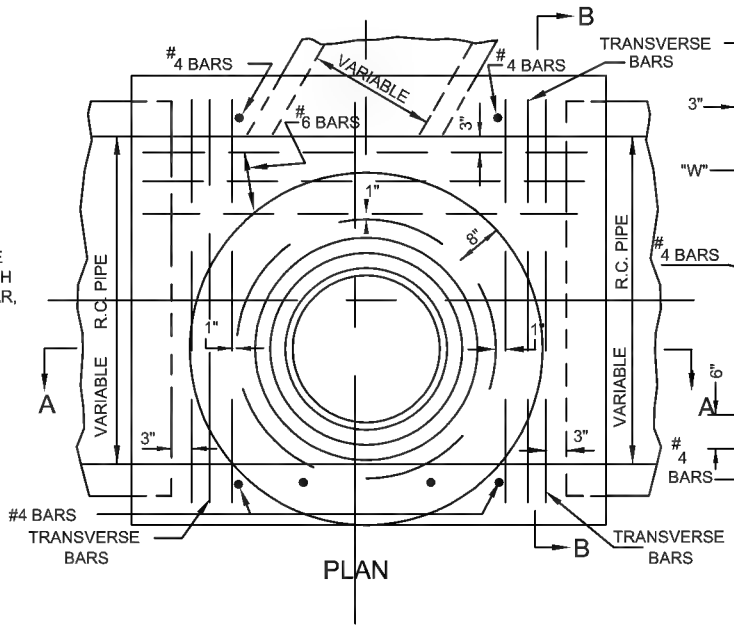
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

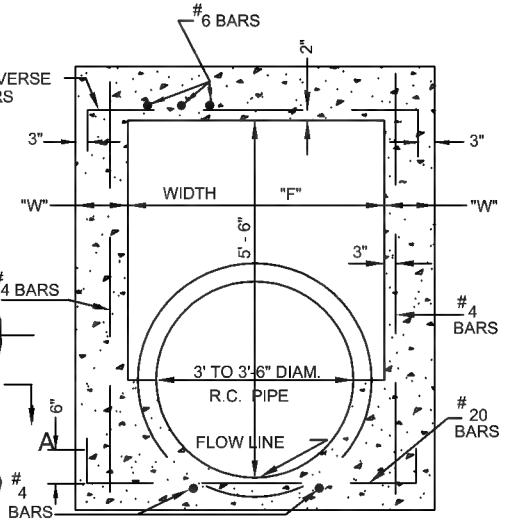
SPECIAL MANHOLES FOR 36" TO 84" DIAMETER R.C. PIPE



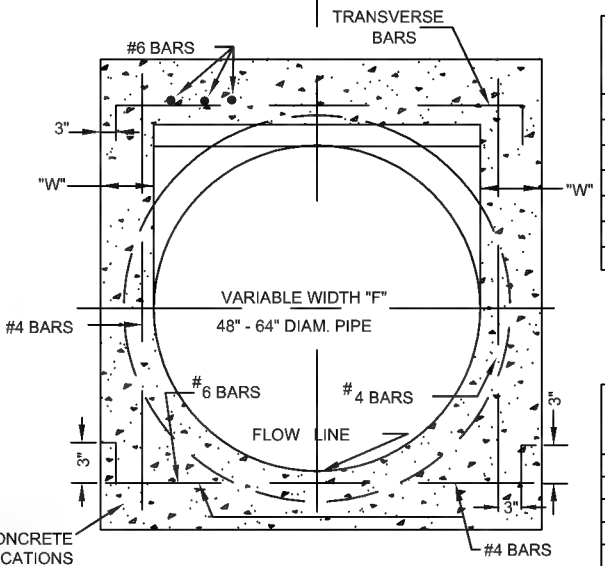
SECTION A-A



PLAN



36" TO 42" DIAM. R.C. PIPE
SECTION B-B



4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

48" TO 84" DIAM. R.C. PIPE
SECTION B-B

TOP AND BOTTOM SLABS & SIDEWALLS TO BE CLASS "B" CONC.

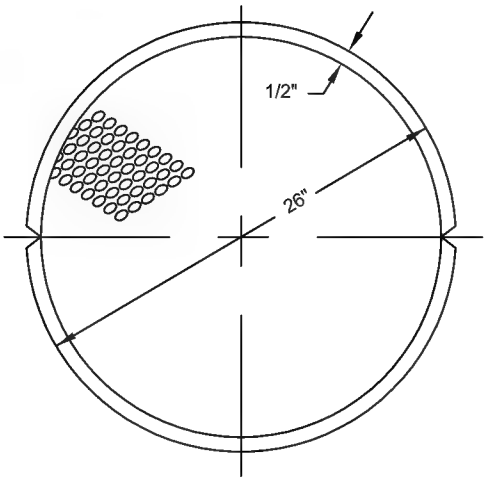
SIZE OF PIPE	WIDTH "F"	HEIGHT "G"	HEIGHT "H"					
			8.0'-15.9'		16.0'-23.9'		24.0'&UP	
			T	W	T	W	T	W
36"	4'-0"	5'-6"	8"	10"	8"	12"	9"	12"
42"	4'-0"	5'-6"	8"	10"	8"	12"	9"	12"
48"	4'-0"	5'-6"	8"	10"	8"	12"	9"	12"
54"	4'-6"	5'-6"	8"	10"	8"	12"	10"	12"
60"	5'-0"	5'-6"	8"	10"	9"	12"	11"	12"
72"	6'-0"	6'-0"	9"	10"	10"	12"	12"	12"
84"	7'-0"	7'-0"	10"	10"	11"	12"	13"	12"

SIZE NUMBER AND SPACING OF BARS.

T	TOP SLAB		BOTTOM SLAB		SIDEWALLS
	TRANS. BARS	LONG BARS	TRANS. #6 BARS	LONG #4 BARS	VERTICAL #4 BARS
8"	6-#7	3-#6	6 1/2" OC	24" OC	12" OC
9"	6-#7	3-#6	5 1/2" OC	DO	DO
10"	6-#8	3-#6	5" OC	DO	DO
11"	6-#8	3-#6	4 1/2" OC	DO	DO
12"	6-#9	3-#6	4" OC	DO	DO
13"	6-#10	3-#6	4" OC	DO	DO

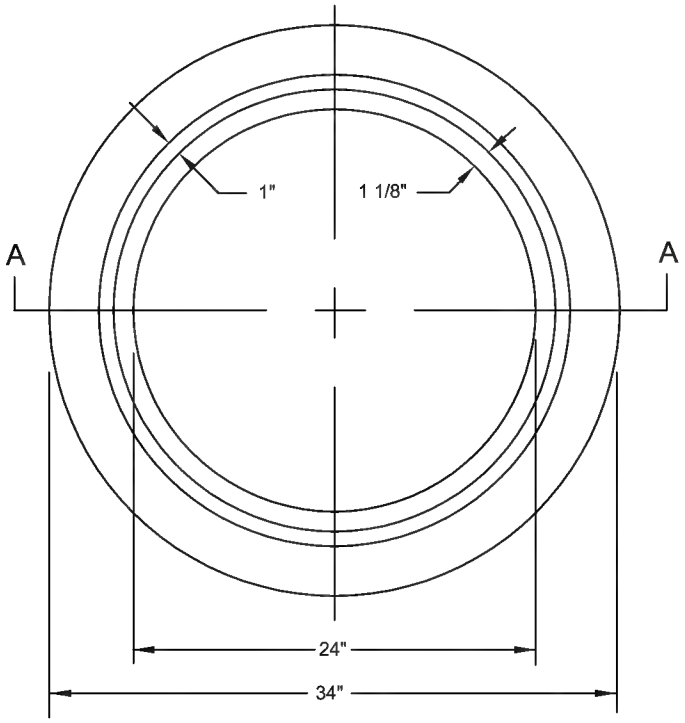
DATE OF ISSUE
OCTOBER 2017

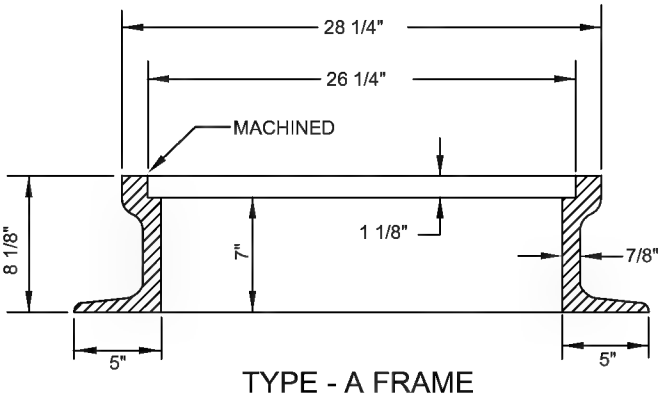
DRAWING NUMBER
E 202.5.0



STANDARD COVER

FOR COVER DETAILS SEE DRAWING E 202.8.0





TYPE - A FRAME

NOTES:

1. MINIMUM MASS - 265 LBS.
2. MATERIAL - CAST IRON - SEE STANDARD SPECIFICATIONS WITH NO BLACK ASPHALT COATING ALLOWED

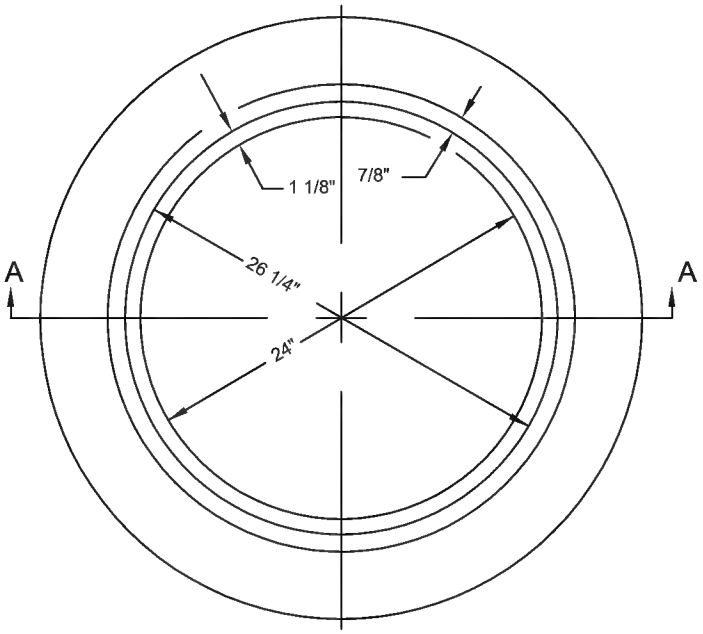
massDOT Massachusetts Department of Transportation Highway Division

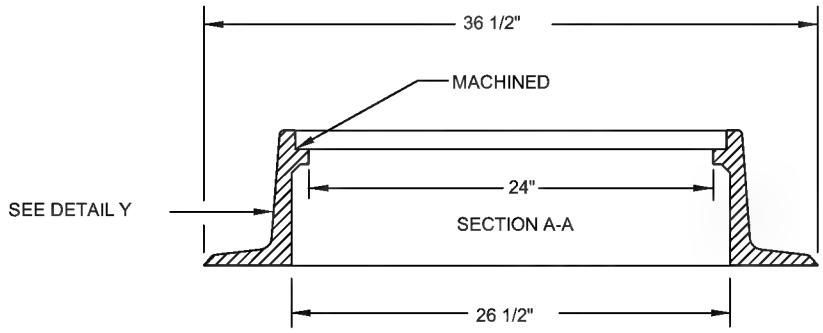
CONSTRUCTION STANDARDS

MANHOLE FRAME AND COVER - A FRAME

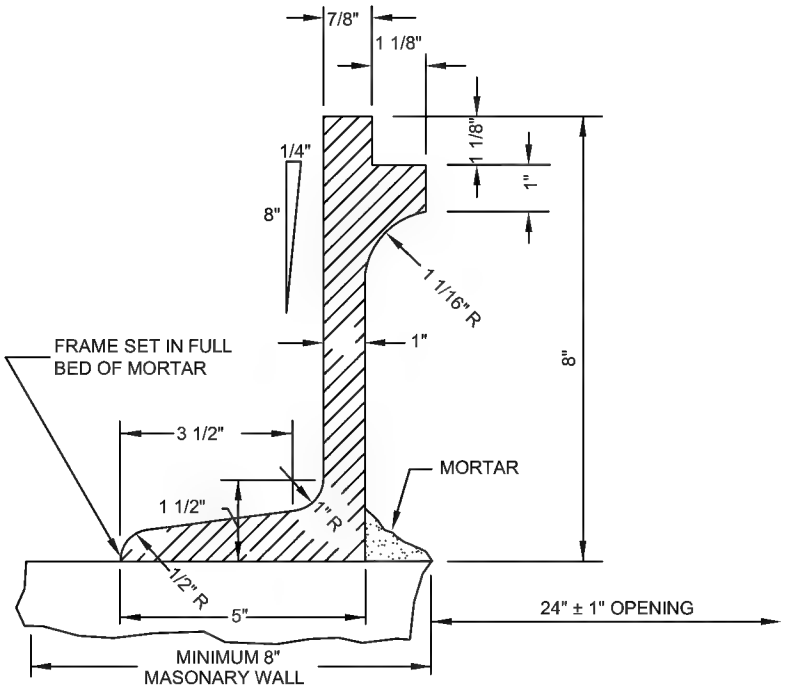
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.6.0

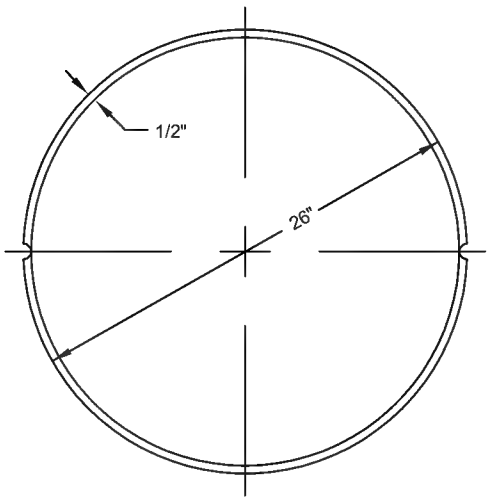




TYPE - B FRAME



DETAIL Y



STANDARD COVER

FOR COVER DETAIL, SEE DRAWING E 202.8.0

NOTES:

1. MINIMUM FRAME MASS 265 LBS.
2. MATERIAL - CAST IRON - SEE STANDARD SPECIFICATIONS WITH NO BLACK ASPHALT COATING ALLOWED

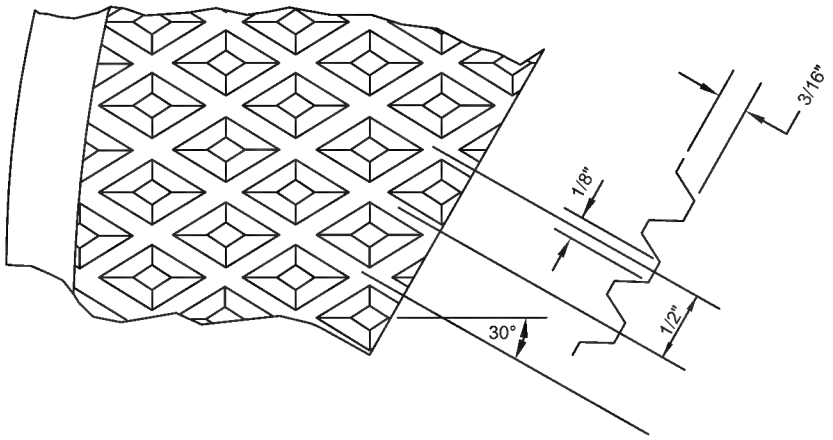
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

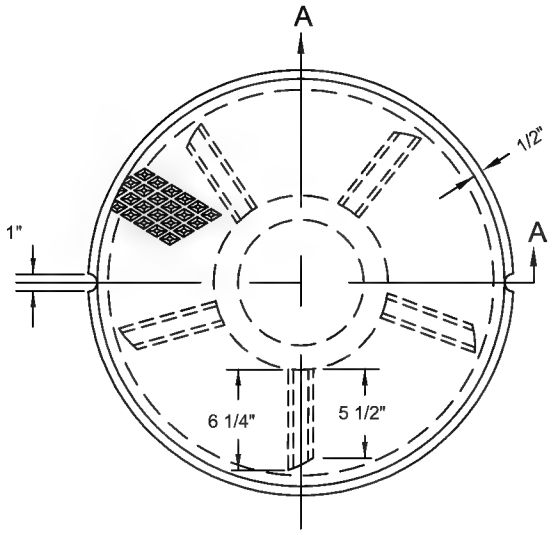
MANHOLE FRAME AND COVER - B FRAME

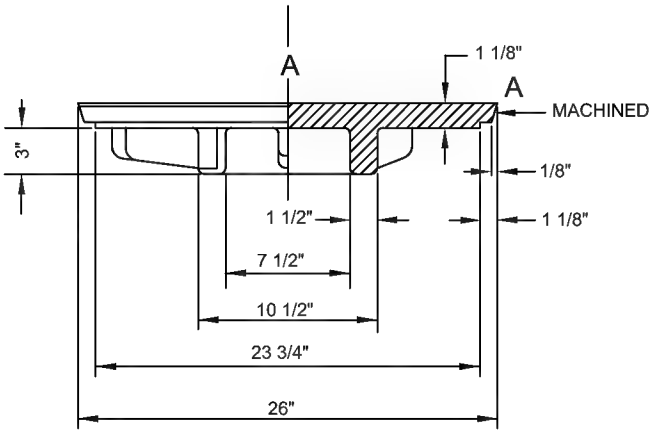
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.7.0

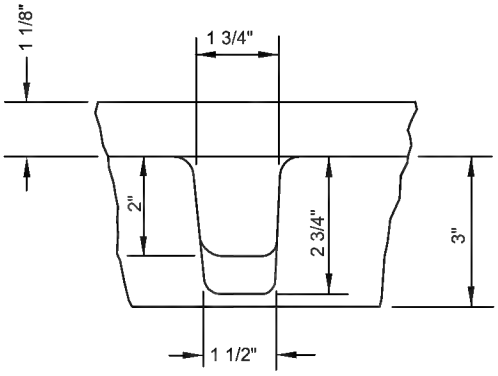


DETAIL OF TREAD





MANHOLE COVER FOR TYPE A & B FRAMES



DETAIL OF FIN

NOTES:

1. MINIMUM COVER MASS - 200 LBS.
2. MATERIAL - CAST IRON - SEE STANDARD SPECIFICATIONS WITH NO BLACK ASPHALT COATING ALLOWED

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

MANHOLE COVER DETAILS

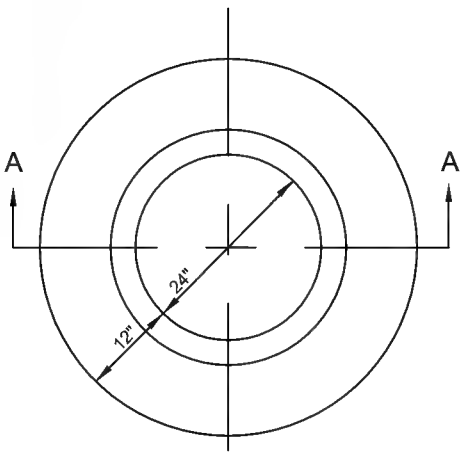
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.8.0

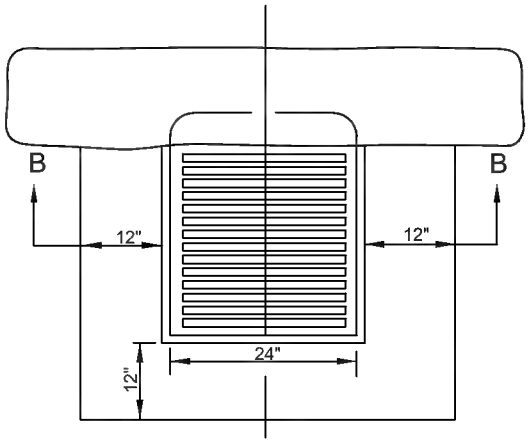
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

CONCRETE COLLARS



PLAN



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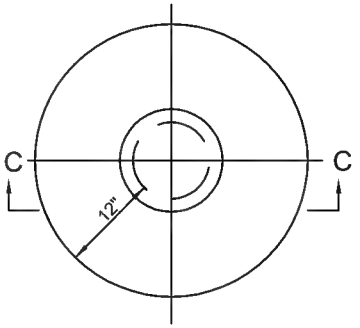
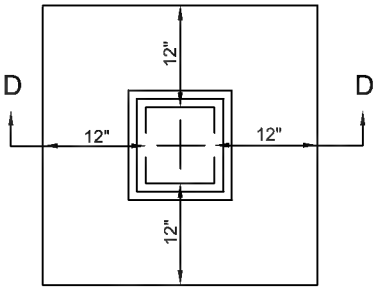
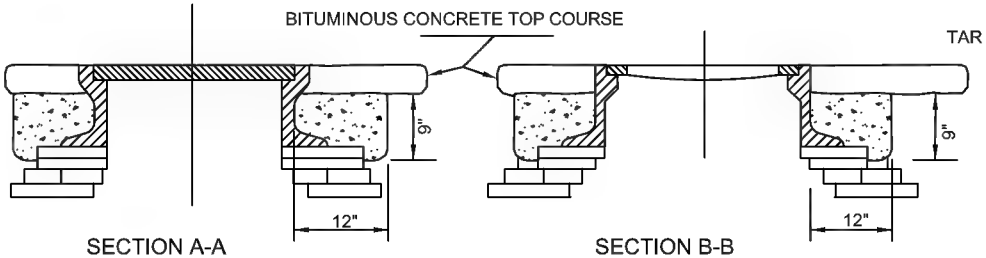


PLAN



PLAN

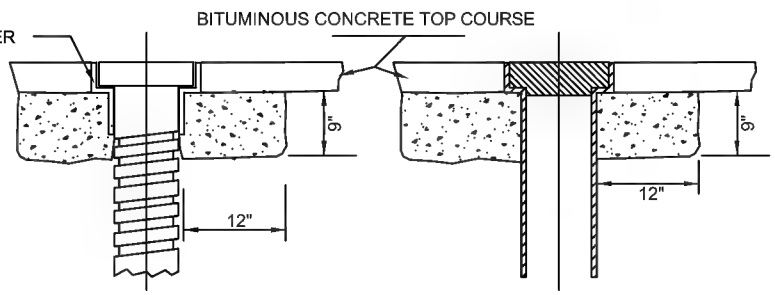


SECTION A-A

MANHOLES

SECTION B-B

CATCH BASINS



SECTION C-C

ROUND

SECTION D-D

SQUARE

WATER SERVICE BOXES

NOTES:

1. COLLARS TO BE 4000PSI CEMENT CONCRETE MASONRY REGULAR OR H.E.S. AS DIRECTED.
   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).
   (IF HAND MIXED, SEE LATEST STANDARD SPECIFICATIONS).
2. NO CONCRETE REQUIRED IN CONCRETE PAVEMENT.

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 202.9.0

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

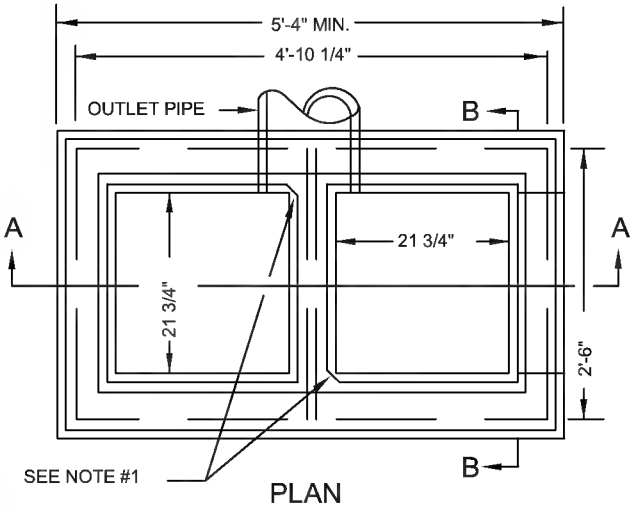
DROP INLETS

TYPE A - PRECAST CONCRETE

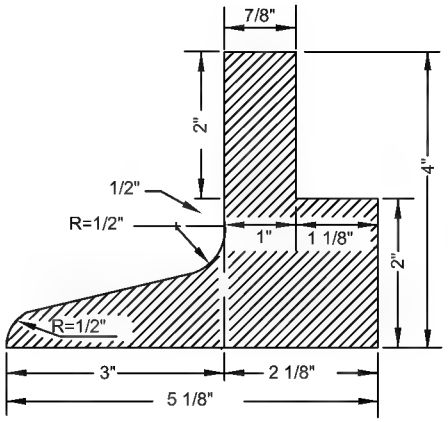
TYPE B - CONCRETE BLOCK

DATE OF ISSUE
OCTOBER 2017

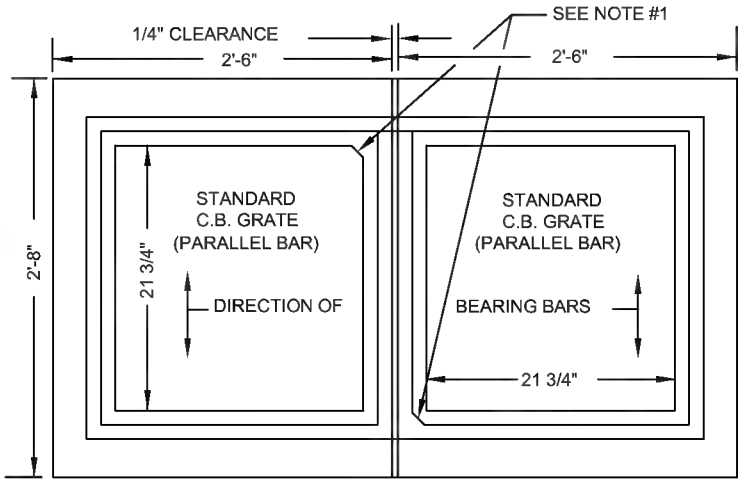
DRAWING NUMBER
E 203.1.0



PLAN

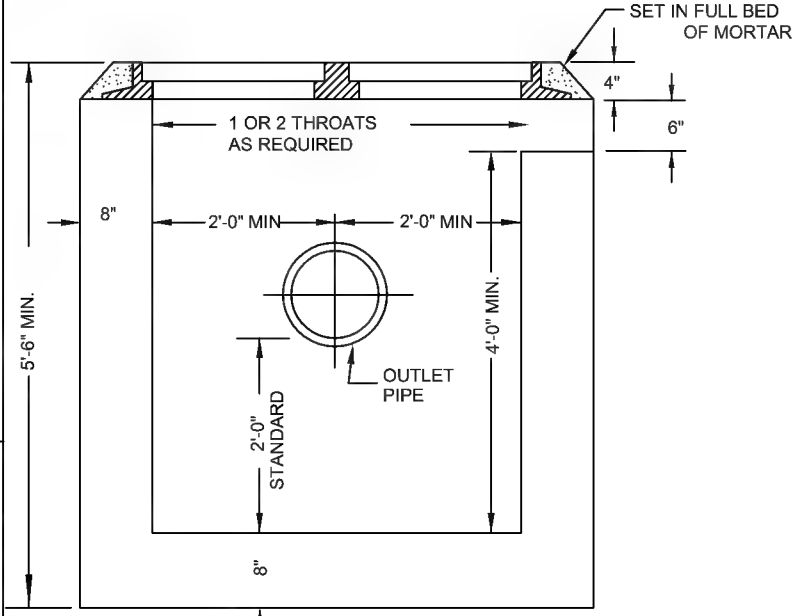


FRAME SECTIONS

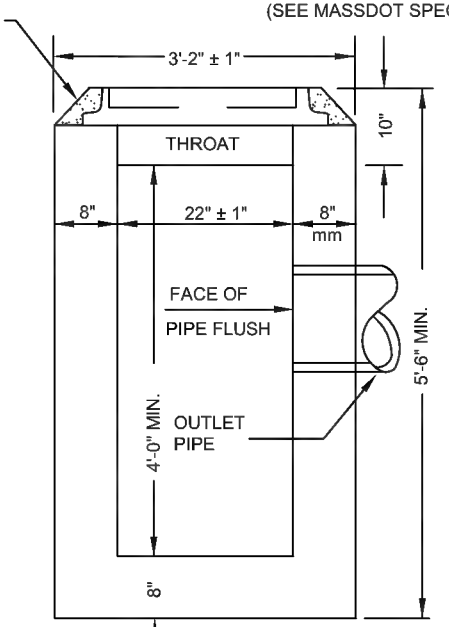


2-3 FLANGE 4" C.I. FRAMES

1. COLLARS TO BE 4000PSI CEMENT CONCRETE MASONRY REGULAR OR H.E.S. AS DIRECTED. (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).



SECTION A-A



SECTION B-B

NOTES:

1. STANDARD PARALLEL BAR GRATES TO BE USED. SEE DETAILS ON DRAWINGS E 201.10.0
2. MINIMUM C.I. FRAME MASS - 205 LBS. EACH
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS SEE LATEST STANDARD SPECIFICATIONS

TYPE"A"

4. 4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).

TYPE"B"

5. NOMINAL CONCRETE BLOCK DIMENSIONS
   HEIGHT, 4" TO 8"
   WIDTH, 8"
   LENGTH, 8" TO 16"
6. BLOCKS TO BE SET IN FULL BED OF MORTAR
7. THIS DROP INLET IS NOT TO BE USED AT ANY LOCATION WHERE IT MAY PRESENT A HAZARD TO VEHICLES THAT RUN OFF THE ROAD. FOR FLUSH TYPE SEE DRAWING E 203.2.0

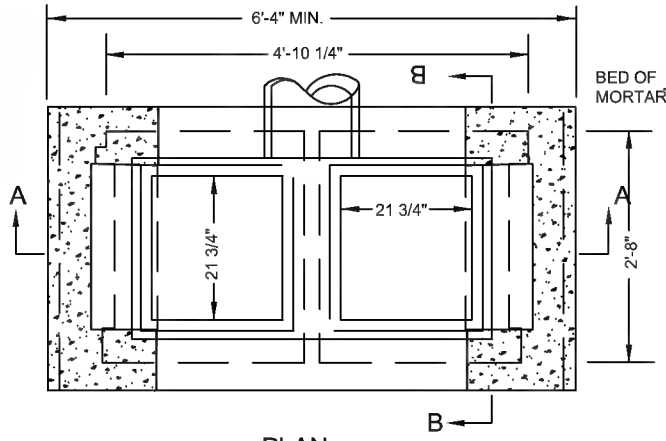
massDOT Highway Division
Massachusetts Department of Transportation
CONSTRUCTION STANDARDS

DROP INLETS

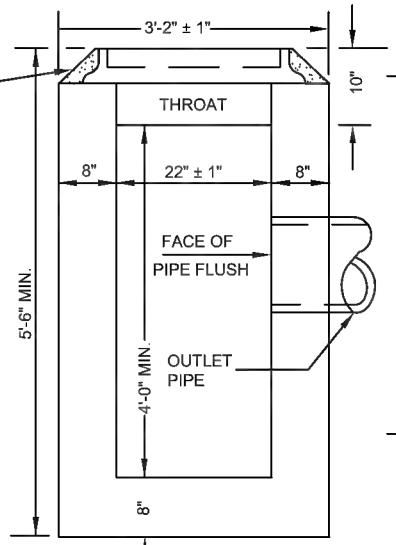
TYPE AF - PRECAST CONCRETE
TYPE BF - CONCRETE BLOCK

DATE OF ISSUE
OCTOBER 2017

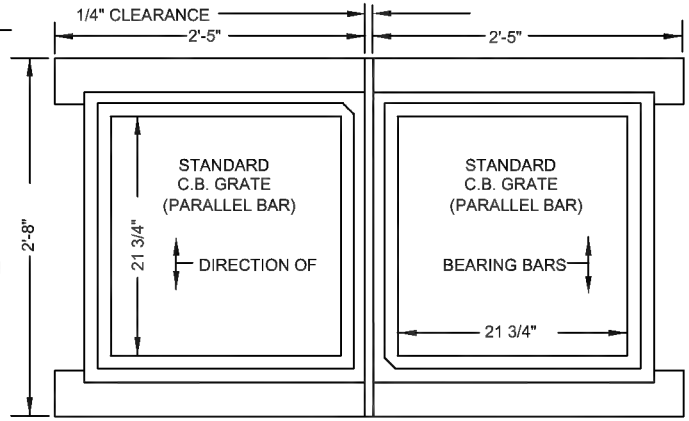
DRAWING NUMBER
E 203.2.0



PLAN

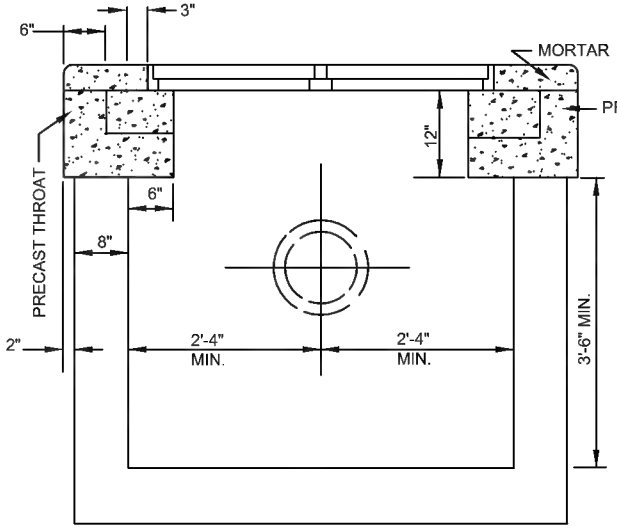


SECTION B-B

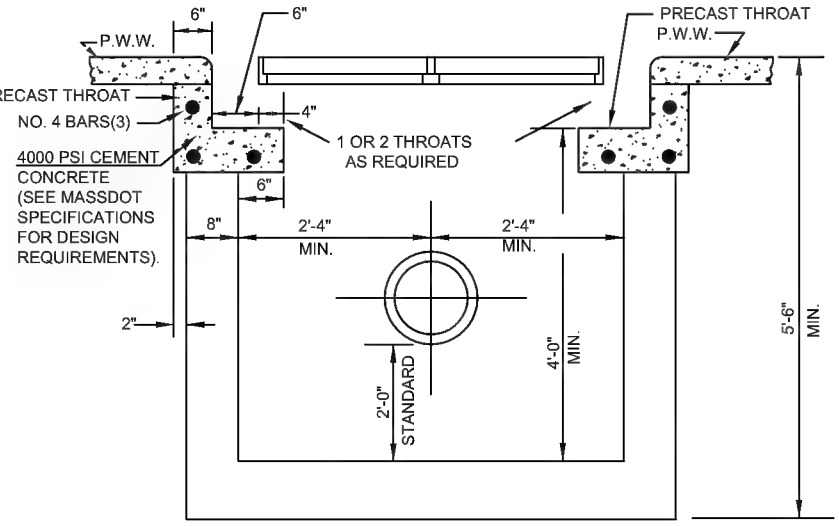


EXCESS FLANGE AREA TO BE REMOVED

2-3 FLANGE 4" C.I. FRAMES



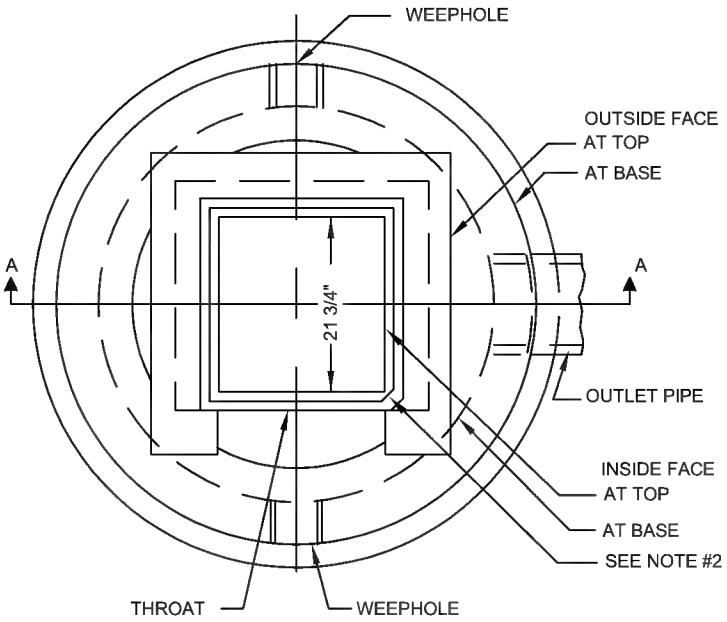
ELEVATION



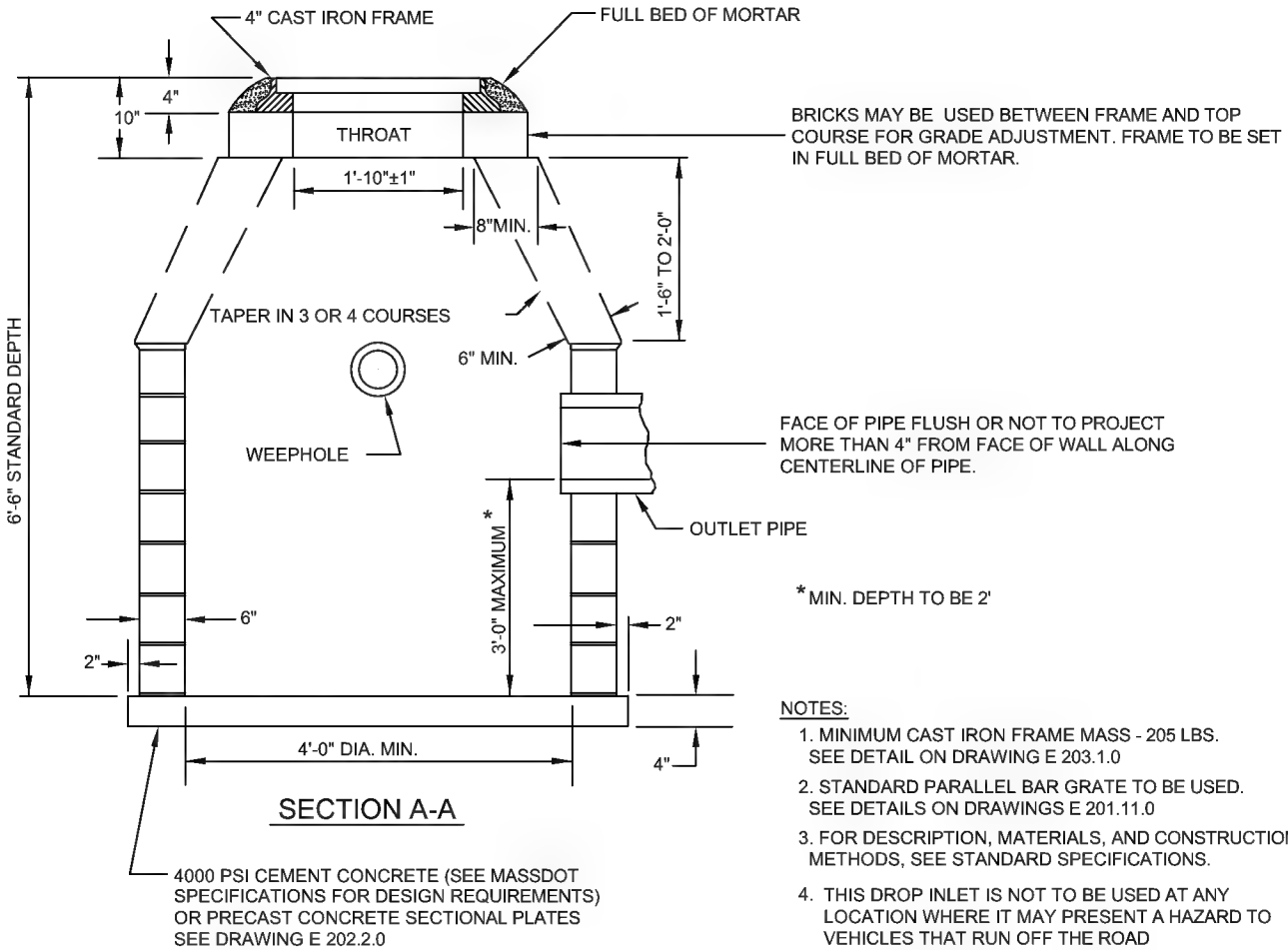
SECTION A-A

NOTES:

1. FOR DETAILS OF PRECAST THROAT SEE DRAWING E 203.7.0
2. SEE DRAWING 203.1.0 FOR DETAILS NOT SHOWN



PLAN



SECTION A-A

*MIN. DEPTH TO BE 2'

NOTES:

1. MINIMUM CAST IRON FRAME MASS - 205 LBS. SEE DETAIL ON DRAWING E 203.1.0
2. STANDARD PARALLEL BAR GRATE TO BE USED. SEE DETAILS ON DRAWINGS E 201.11.0
3. FOR DESCRIPTION, MATERIALS, AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. THIS DROP INLET IS NOT TO BE USED AT ANY LOCATION WHERE IT MAY PRESENT A HAZARD TO VEHICLES THAT RUN OFF THE ROAD FOR FLUSH TYPE SEE DRAWING E 203.4.0
5. SEE DRAWING E 201.3.0 CONCRETE BLOCK CATCH BASIN FOR DETAILS

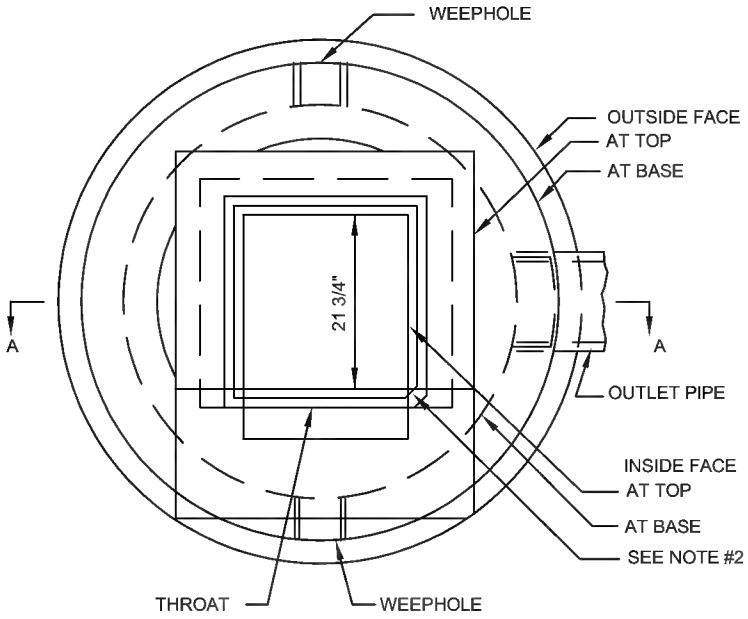
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

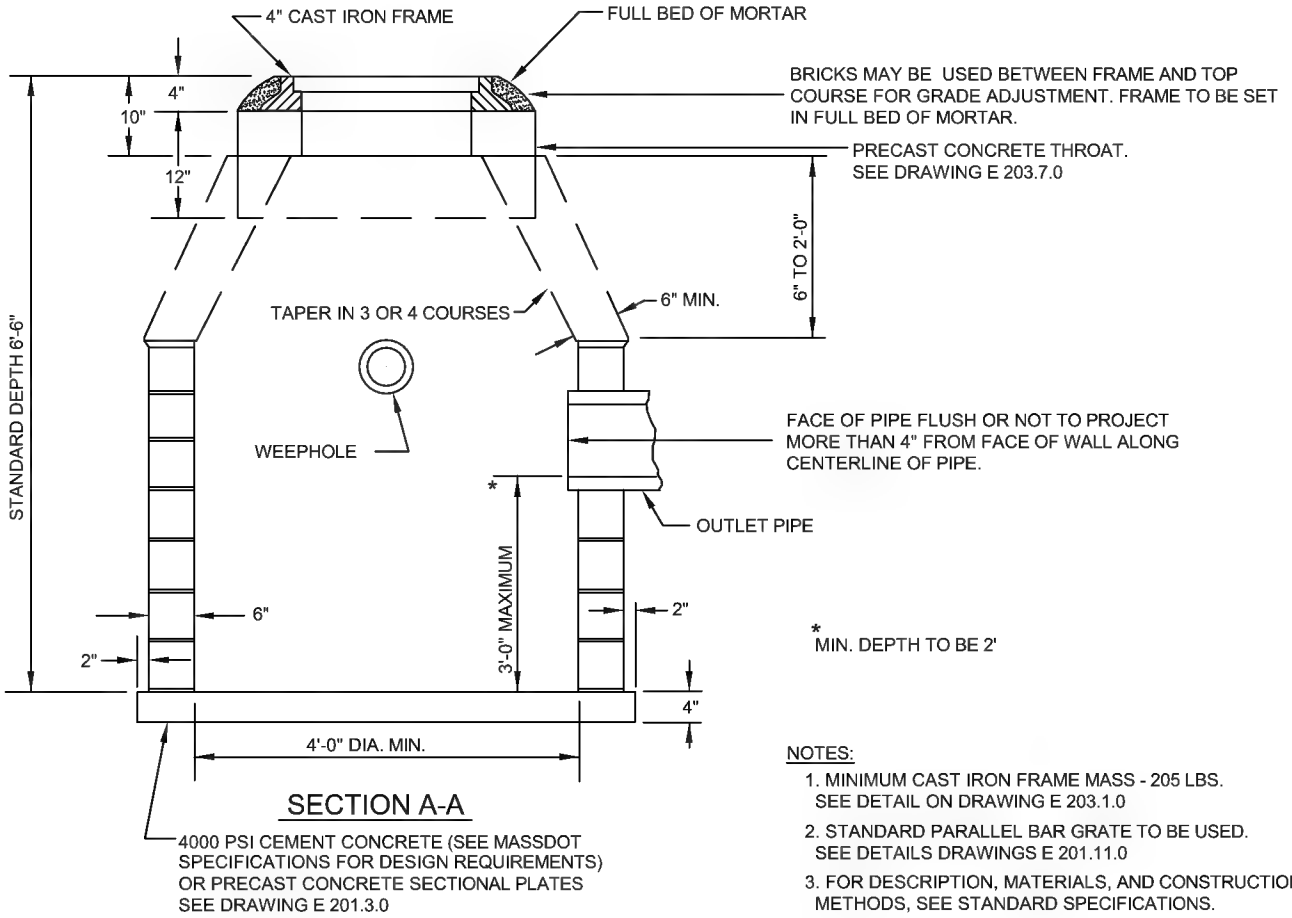
DROP INLET TYPE C

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 203.3.0



PLAN



SECTION A-A

4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS) OR PRECAST CONCRETE SECTIONAL PLATES SEE DRAWING E 201.3.0

* MIN. DEPTH TO BE 2'

NOTES:

1. MINIMUM CAST IRON FRAME MASS - 205 LBS. SEE DETAIL ON DRAWING E 203.1.0
2. STANDARD PARALLEL BAR GRATE TO BE USED. SEE DETAILS DRAWINGS E 201.11.0
3. FOR DESCRIPTION, MATERIALS, AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
4. TO BE USED IN MEDIANS AND DITCHES THAT ARE WITHIN THE RECOVERY AREA.
5. SEE DRAWING E 201.3.0 CONCRETE BLOCK CATCH BASIN FOR DETAILS

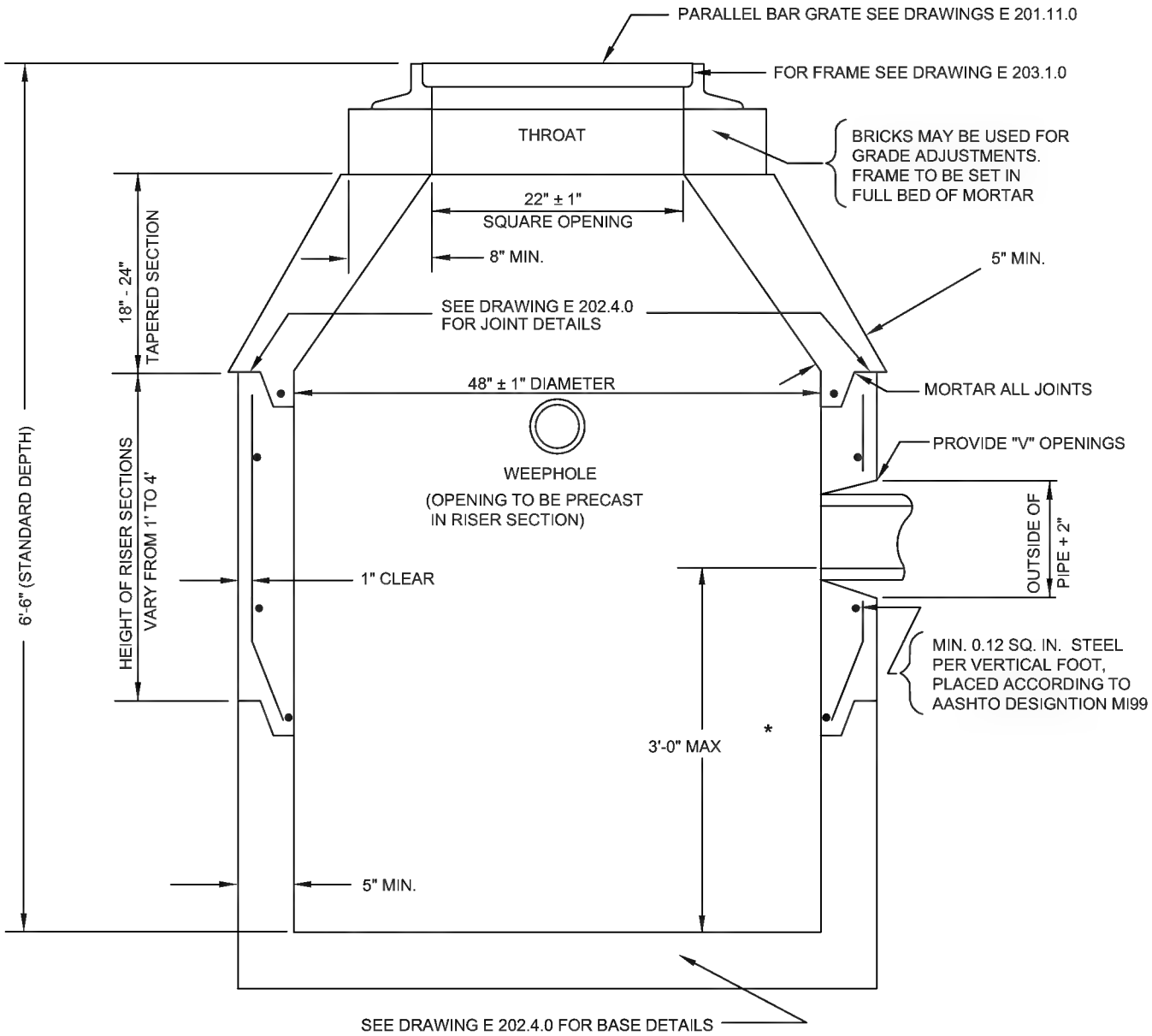
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

DROP INLET TYPE CF

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 203.4.0



* MINIMUM DEPTH OF SUMP TO BE 2'

NOTES:

1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWING E 203.3.0
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHOD, SEE LATEST STANDARD SPECIFICATIONS
3. THIS DROP INLET IS NOT TO BE USED AT ANY LOCATION WHERE IT MAY PRESENT A HAZARD TO VEHICLES THAT RUN OFF THE ROAD. FOR FLUSH TYPE SEE DRAWING E 203.6.0

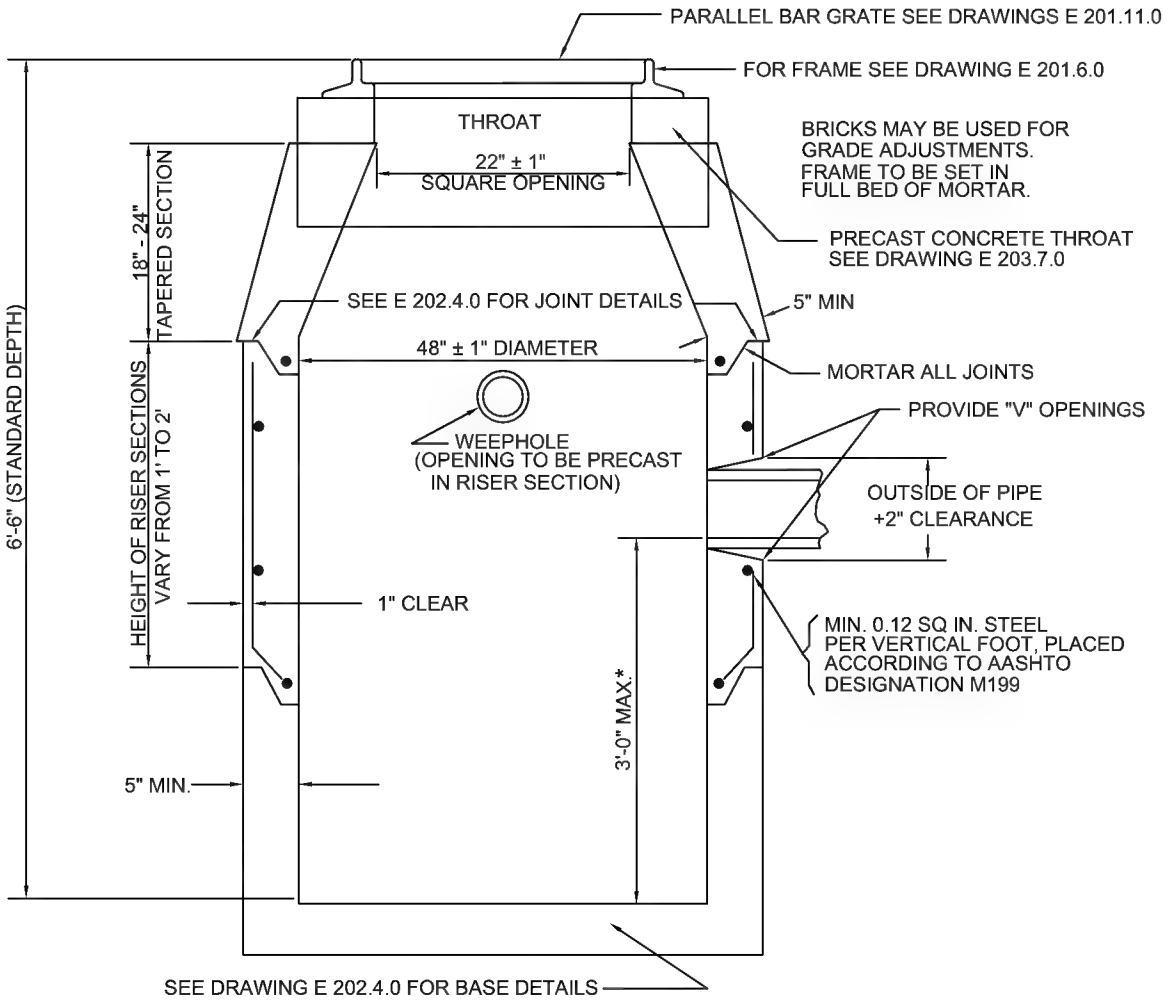
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

DROP INLET TYPE D

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 203.5.0



*MINIMUM DEPTH OF SUMP TO BE 2'

NOTES:

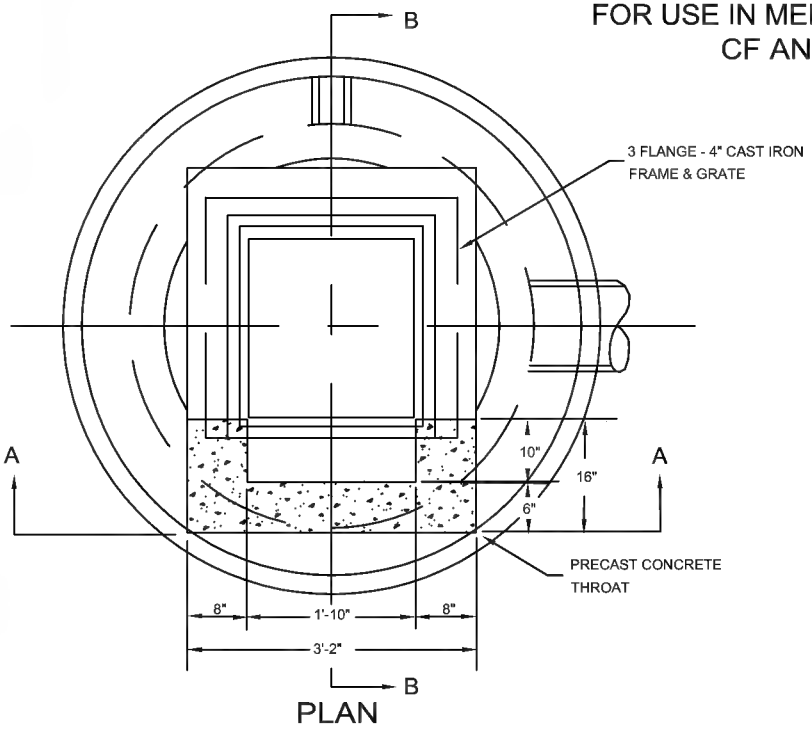
1. DETAILS NOT INDICATED ABOVE ARE TO BE SIMILAR TO THOSE SHOWN ON DRAWINGS E 203.3.0 AND E 203.4.0
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHOD, SEE LATEST STANDARD SPEFICATIONS
3. TO BE USED IN MEDIANS AND DITCHES THAT ARE WITHIN THE RECOVERY AREA

CONSTRUCTION STANDARDS

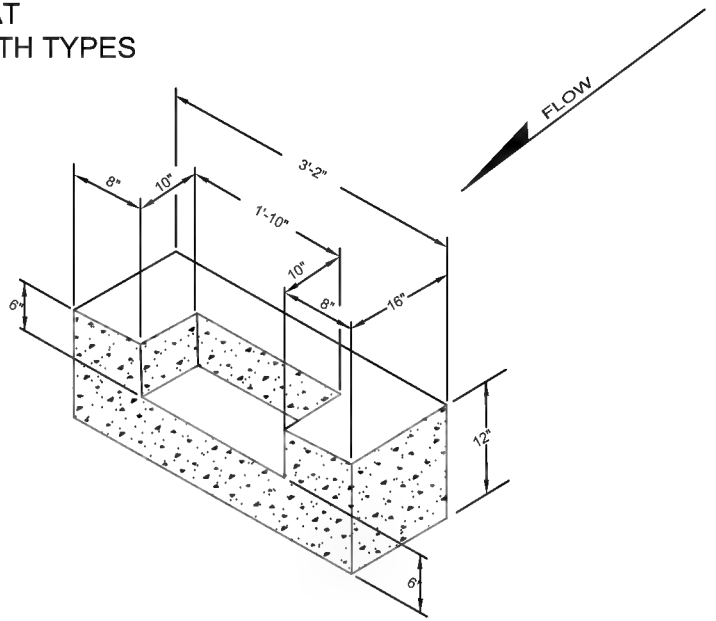
massDOT Highway Division
Massachusetts Department of Transportation

FLUSH DROP INLET THROAT

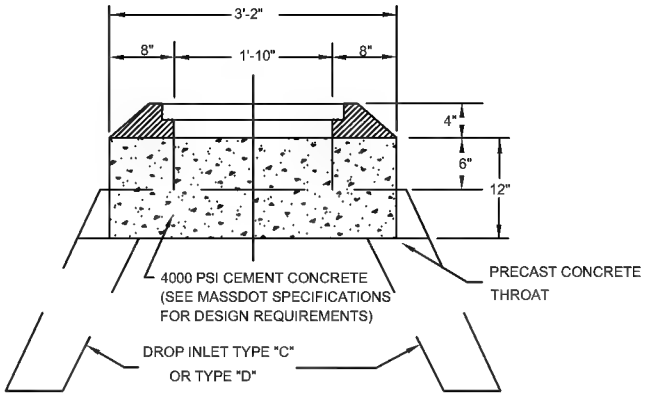
PRECAST CONCRETE THROAT FOR USE IN MEDIANS & DITCHES WITH TYPES CF AND DF DROP INLETS



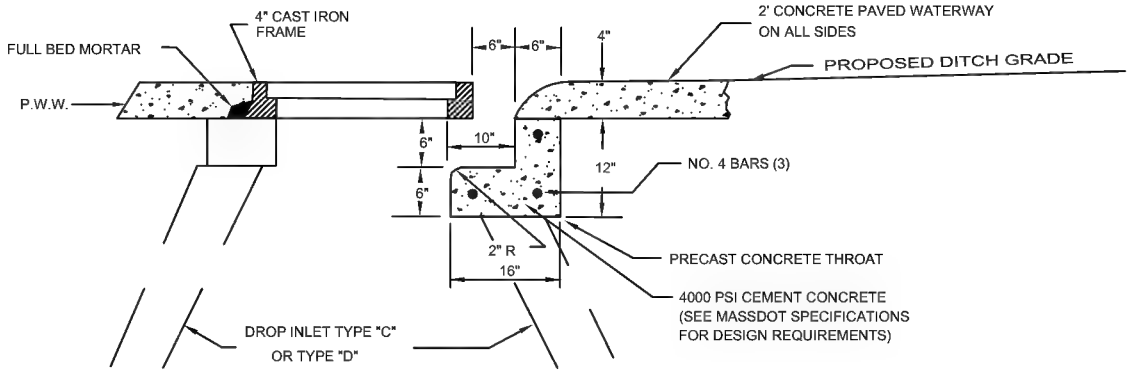
PLAN



ISOMETRIC OF PRECAST CONCRETE THROAT OPENING



SECTION A-A



SECTION B-B

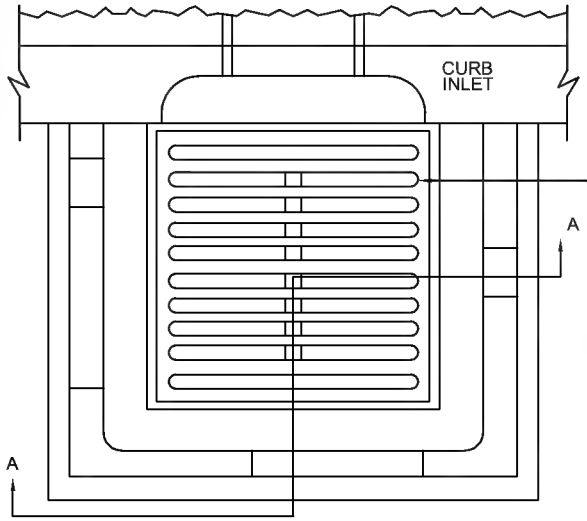
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 203.7.0

CONSTRUCTION STANDARDS

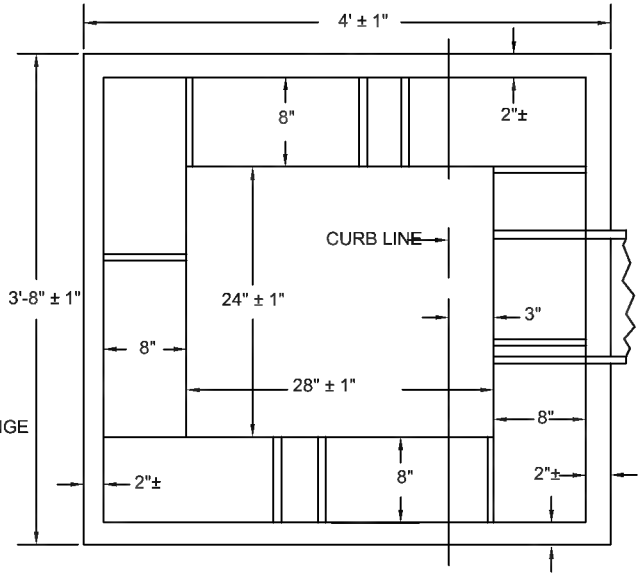
massDOT Highway Division
Massachusetts Department of Transportation

GUTTER INLET

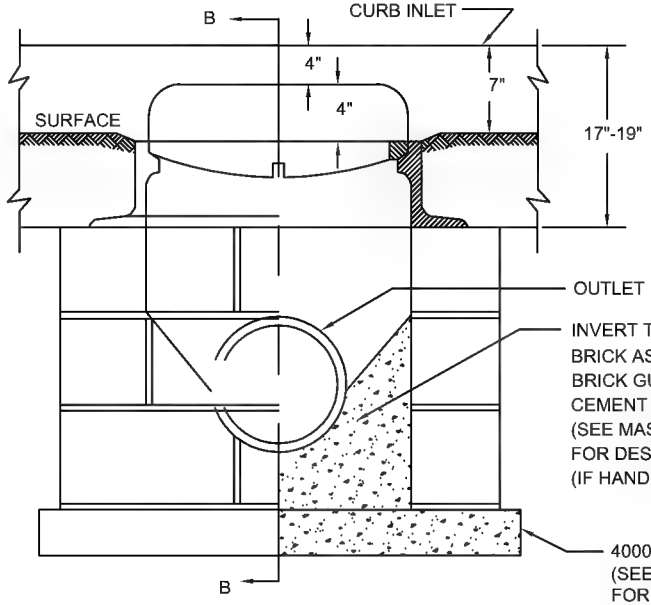


NOTES:

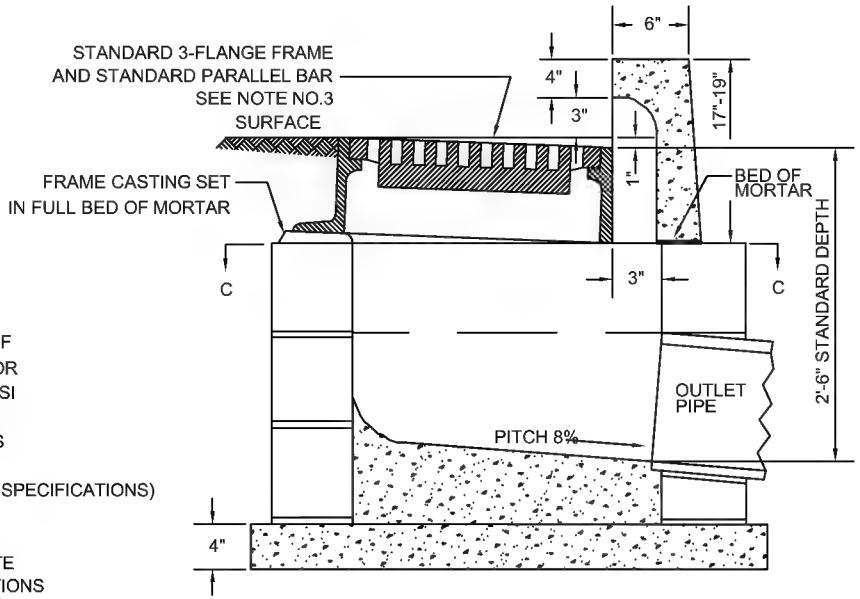
1. WHERE CURB INLET IS NOT USED THE INSIDE HORIZONTAL DIMENSIONS OF GUTTER INLET TO BE 24"±1" X 24"±1" IN WHICH CASE AND UNLESS OTHERWISE DIRECTED, A STANDARD 4-FLANGE FRAME IS TO BE USED.
2. BRICKS MAY BE USED BETWEEN TOP COURSE AND FRAME FOR GRADE ADJUSTMENT.
3. A CASCADE GRATE IS TO BE USED WHERE BICYCLE TRAVEL IS ALLOWED.
4. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.



SECTION C-C



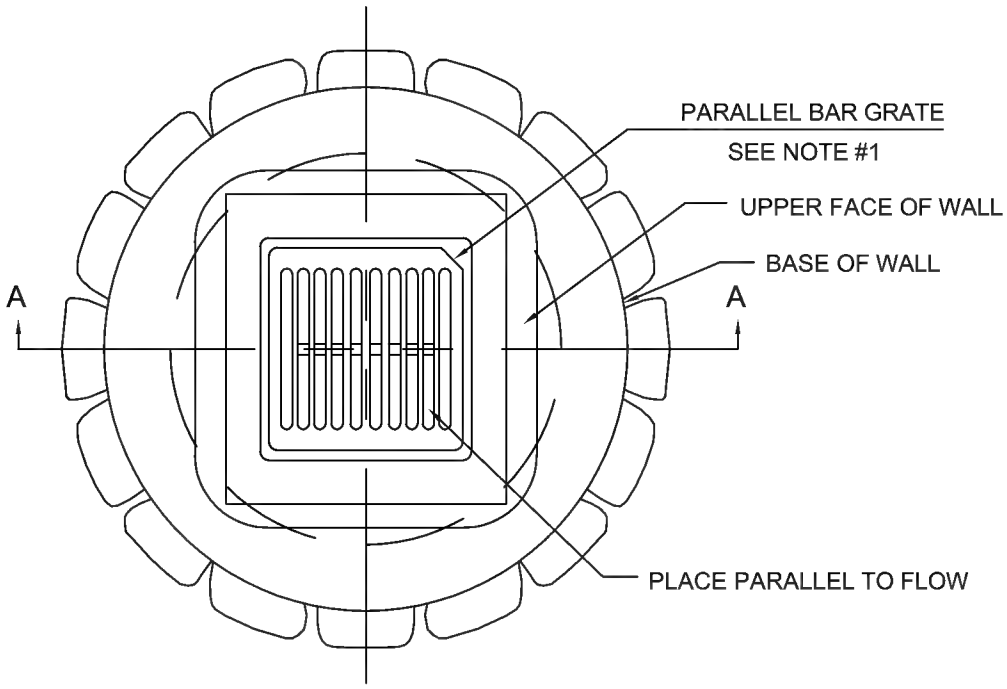
SECTION A-A



SECTION B-B

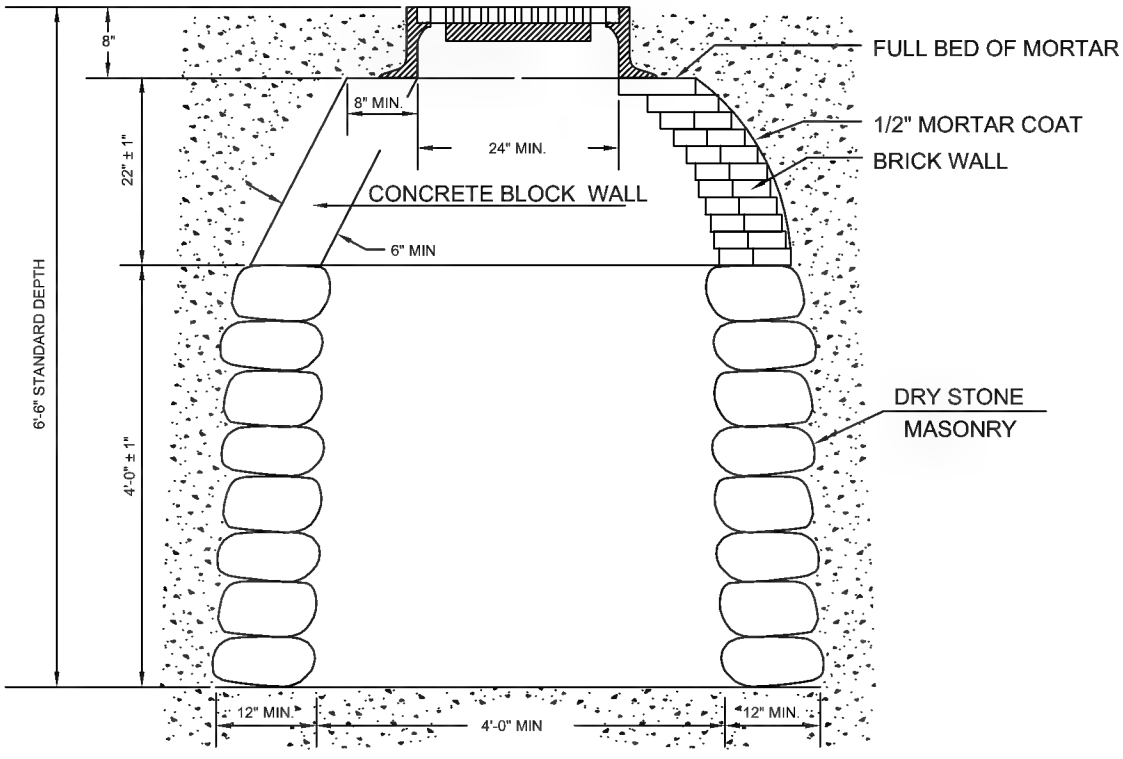
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 204.2.0



NOTES:

1. USE CASCADE GRATE WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED. SEE DRAWINGS E 201.7.0 - E 201.9.0
2. BRICK WALL TO BE 8" THICK; EVERY FIFTH COURSE TO BE HEADERS; OUTSIDE TO BE FINISHED WITH CEMENT MORTAR COATING.
3. WHEN USING CONCRETE BLOCKS, BLOCKS TO BE SET IN FULL BED OF MORTAR AND TAPERED IN 3 OR 4 COURSES.
4. BACKFILL FOR FULL DEPTH OF BASIN EXCAVATION TO BE GRAVEL.
5. FOR DESCRIPTION, MATERIALS AND METHOD OF CONSTRUCTION SEE STANDARD SPECIFICATIONS.



SECTION A-A

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

DRY STONE MASONRY LEACHING BASIN

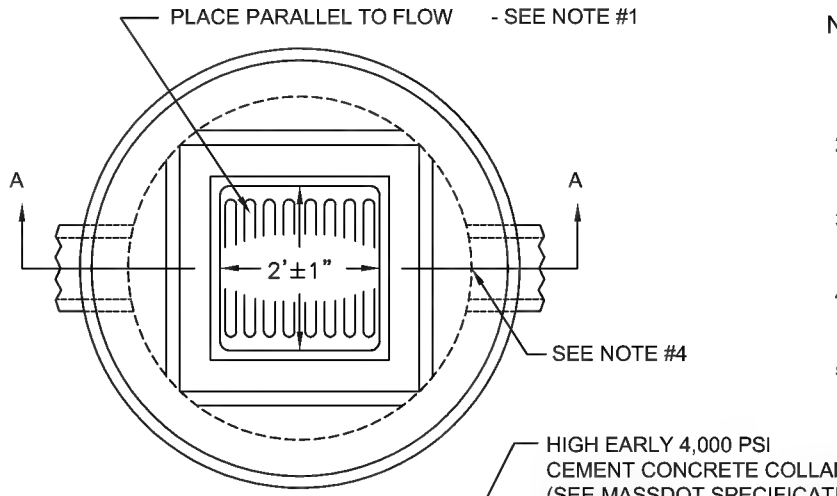
DATE OF ISSUE
OCTOBER 2017

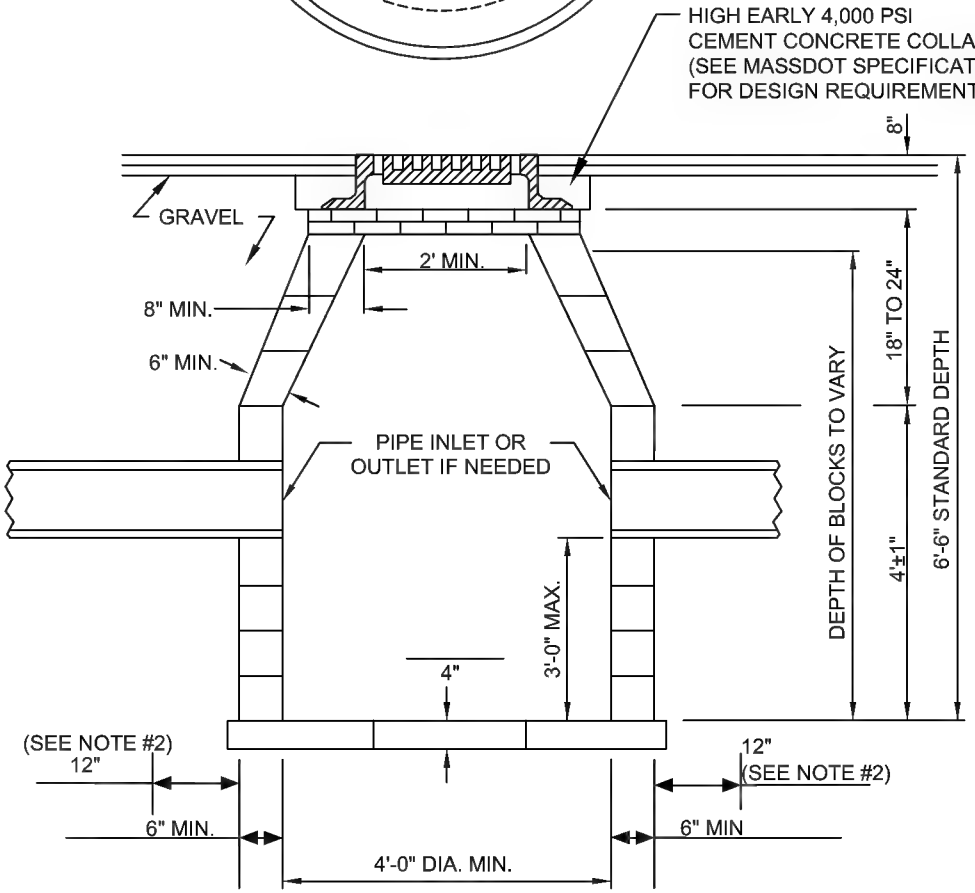
DRAWING NUMBER
E 205.1.0

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

CONCRETE BLOCK LEACHING BASIN



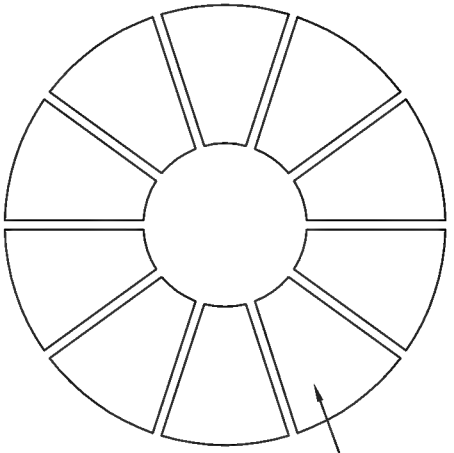


SECTION A-A

NOTES:

1. **USE CASCADE GRATE WHERE BICYCLE TRAVEL IS LEGALLY ALLOWED. SEE DRAWINGS E 201.7.0 - E 201.9.0.**
2. BACKFILL FOR FULL DEPTH OF BASIN EXCAVATION TO BE 1/2" CRUSHED STONE.
3. FOR DESCRIPTION, MATERIALS, AND METHOD OF CONSTRUCTION SEE STANDARD SPECIFICATIONS.
4. FACE OF PIPE FLUSH OR NOT TO PROJECT MORE THAN 4" FROM FACE OF WALL ALONG CENTERLINE OF PIPE.
5. THE LEACHING BASIN SHALL BE CONSTRUCTED OF CEMENT CONCRETE BLOCKS TO CONFORM TO THE REQUIREMENTS OF STANDARD SPECIFICATION SUBSECTION M4.05.1.

PLAN OF BASE



BOTTOM PLATES REQUIRE
10 PIECES PER CIRCLE WITH
1/2" SPACING BETWEEN PLATES.
4" THICK

DATE OF ISSUE
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E 205.2.0

massDOT Highway Division
Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CORRUGATED STEEL METAL PIPE
TABLE OF MINIMUM WALL THICKNESS

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 206.1.0

TABLE OF MINIMUM WALL THICKNESS (FT)
(2 2/3" x 1/2" CORRUGATION)

DIA. (IN)	HEIGHT OF COVER ABOVE TOP OF PIPE (FEET)										
	MIN. - 10	11 - 15	16 - 20	21 - 25	26 - 30	31 - 35	38 - 40	41 - 45	46 - 50	51 - 55	56 - 60
15	16	16	16	16	16	16	16	16			
18	16	16	16	16	16	16	14	14	14		
21	16	16	16	16	16	16	14	14	14	12	
24	16	16	16	14	14	14	14	12	12	10	10
30	14	14	14	14	12	12	12	10	10	10	8
36	14	14	12	12	10	10	10	10	8	8	8
42	12	12	12	10	10	10	8	8	8	8	8
48	12	12	12	10	8	8	10	10	10	8	8
54	10	10	8	8	10	10	10	8	8		
60	8	10	10	10	8	8	8	8			
66	10	10	10	8	8	8	8				
72	8	8	8	8	8						

NOTES:
1. ALL PIPE BELOW SOLID LINE TO BE SHOP STRUTTED AS PER STATE SPECIFICATIONS
2. MINIMUM COVER IS TOP OF PIPE TO ROAD - 18" GRADE

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

CORRUGATED STEEL METAL PIPE ARCH - TABLE OF MINIMUM WALL THICKNESS

TABLE OF MINIMUM WALL THICKNESS (IN.)

MADE FROM PIPE OF DIA. (IN.)	SPAN (IN.)	RISE (IN.)	HEIGHT OF COVER ABOVE TOP OF PIPE ARCH (FEET)			
			MIN. - 3	4 - 5	6 - 10	11 - 15
15	18	11	16	16	16	16
18	22	13	16	16	16	16
24	29	18	14	14	14	14
30	36	22	14	14	14	14
36	43	27	12	12	12	12
42	50	31	12	12	12	12
48	58	36	10	12	12	10
54	65	40	10	10	10	8
60	72	44	8	8	8	

NOTES:

1. MINIMUM COVER IS TOP OF PIPE TO ROAD GRADE - 18"
2. FOR HEAVIER FILLS USE STRUCTURAL PLATE

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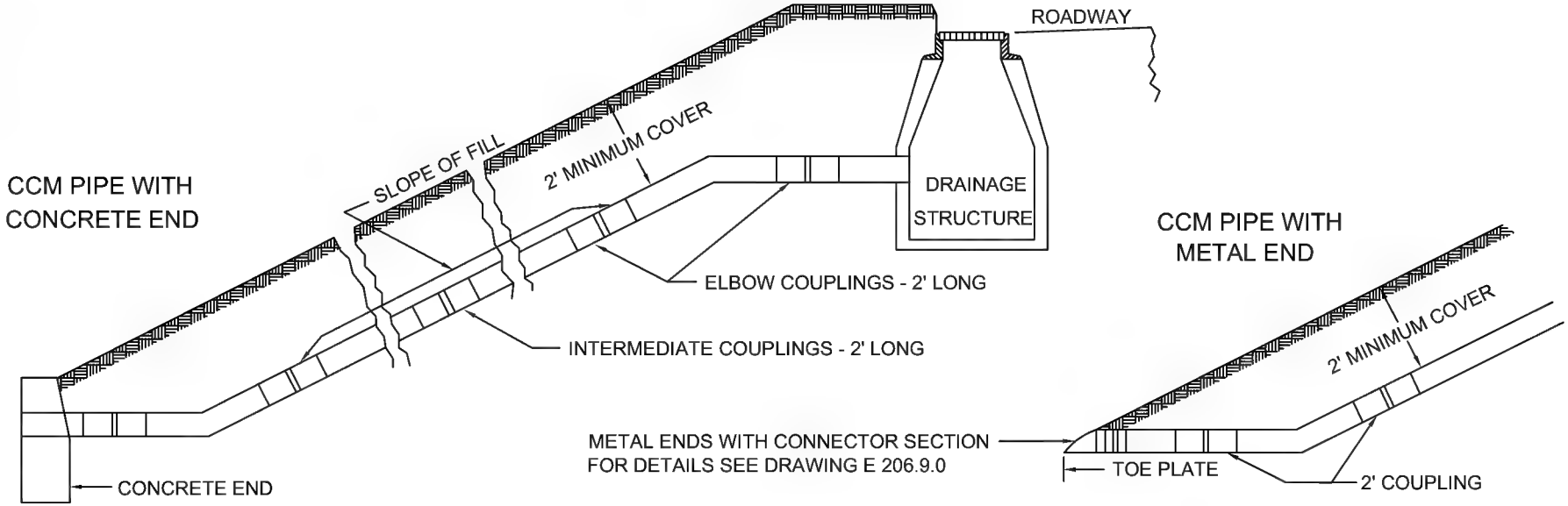
OCTOBER 2017

DRAWING NUMBER
E 206.2.0

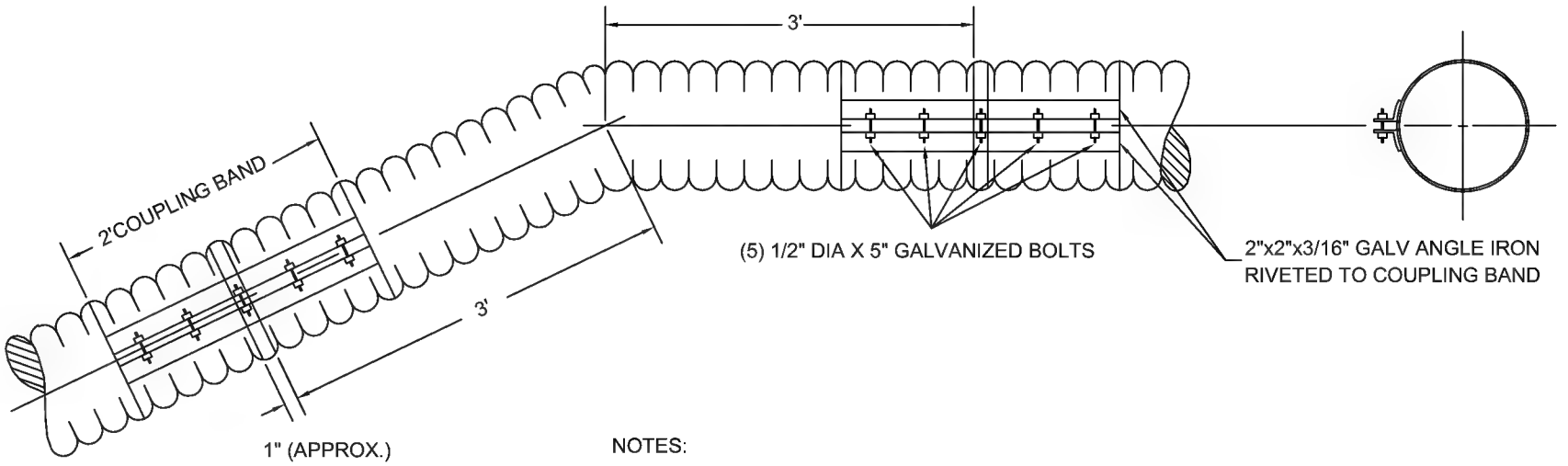
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

CORRUGATED METAL PIPE UNDER FILL SLOPES



ELBOW AND COUPLING DETAILS



NOTES:

1. A TOE PLATE IS REQUIRED FOR ALL METAL ENDS.
2. ALL METAL END UNITS AND ELBOWS TO BE SHOP FABRICATED.

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DRAWING NUMBER
E 206.3.0

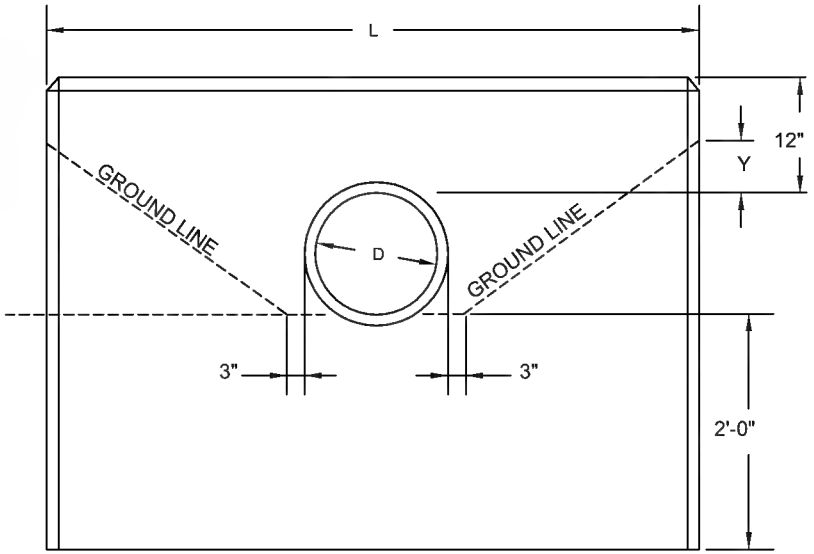
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

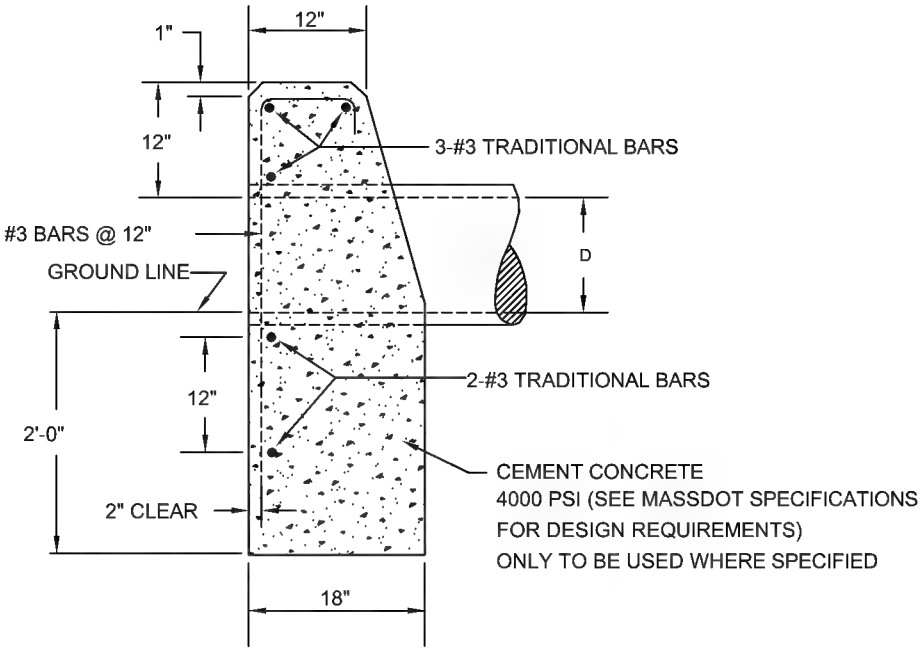
CONCRETE AND FIELD STONE MASONRY PIPE ENDS FOR 8" TO 30" PIPE

DATE OF ISSUE
OCTOBER 2017

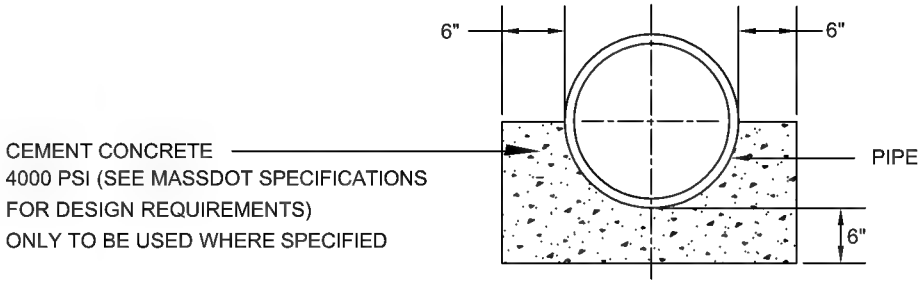
DRAWING NUMBER
E 206.4.0



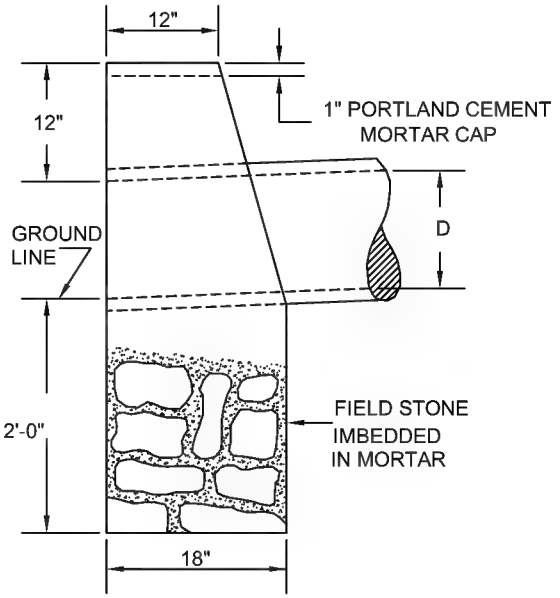
FRONT ELEVATION



END ELEVATION



CONCRETE CRADLE
FOR PIPE CULVERTS



END ELEVATION

NOTES:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.
2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENTS WILL BE BASED ON THE ACCOMPANYING TABLE.
4. FOR QUANTITY TABLES SEE E 206.4.1

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

QUANTITY TABLES FOR CONCRETE AND FIELD STONE MASONRY PIPE ENDS

DATE OF ISSUE
OCTOBER 2017

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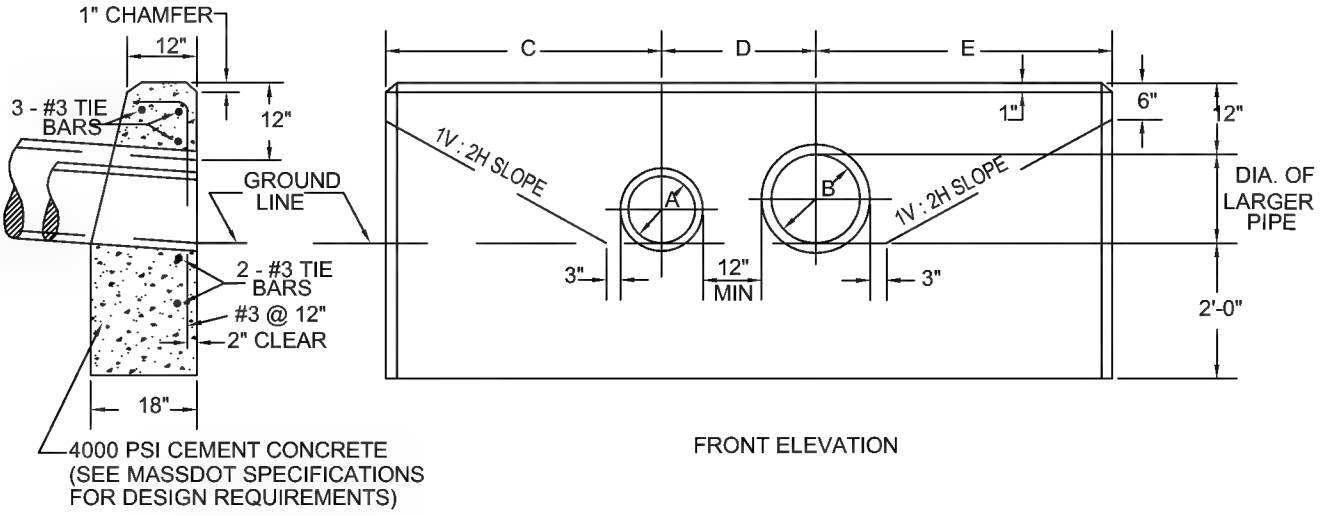
E 206.4.1

ENGLISH UNITS

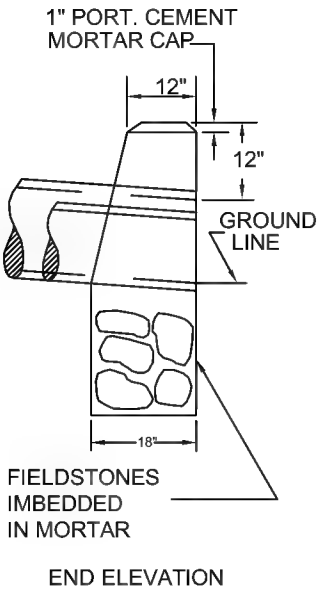
PIPE DIAM. D	1 1/2 : 1 SLOPE				2 : 1 SLOPE			
	L	CONC. OR F.S.M. CU. YDS.	STEEL LBS.	TRENCH EXCAV. 1'-0" DEPTH CU. FT.	L	CONC. OR F.S.M. CU. YDS.	STEEL LBS.	TRENCH EXCAV. 1'-0" DEPTH CU. FT.
8"	4'-2"	0.77	15	21.60	5'-10"	1.08	21	27.40
10"	4'-10"	0.92	20	23.91	6'-8"	1.28	23	30.35
12"	5'-6"	1.08	21	26.25	7'-6"	1.49	29	33.25
15"	6'-6"	1.34	24	29.75	8'-9"	1.82	32	37.63
18"	7'-6"	1.61	30	33.25	10'-0"	2.18	39	42.00
21"	8'-6"	1.95	34	37.35	11'-6"	2.62	43	47.25
24"	9'-3"	2.16	35	39.38	12'-6"	2.97	50	50.75
30"	10'-6"	2.63	44	43.75	15'-0"	3.86	62	59.50

	Y	4" FOR 1 1/2 : 1 SLOPE
		6" FOR 2 : 1 SLOPE



END ELEVATION

FRONT ELEVATION



END ELEVATION

DESIGN NO.	DIAMETER (IN.)		LENGTHS			MASONRY (CY)	STEEL (LBS)	TRENCH EXCAV. 1'-0" DEPTH (CF)
	A	B	C	D	E			
1	12	12	3'-9"	2'-2"	3'-9"	1.89	37	40.85
2	12	15	4'-3"	2'-4"	4'-5"	2.27	42	45.50
3	12	18	4'-9"	2'-6"	5'-0"	2.66	48	49.88
4	12	21	5'-4"	2'-8"	5'-8"	3.12	54	54.85
5	12	24	5'-9"	2'-10"	6'-3"	3.54	59	58.91
6	12	30	6'-9"	3'-0"	7'-6"	4.48	71	67.38
7	15	15	4'-5"	2'-6"	4'-5"	2.32	41	46.66
8	15	18	4'-11"	2'-8"	5'-0"	2.72	48	51.03
9	15	21	5'-5"	2'-10"	5'-8"	3.16	54	55.72
10	15	24	5'-11"	3'-0"	6'-3"	3.60	60	60.10
11	15	30	6'-11"	3'-2"	7'-6"	4.54	72	68.53
12	18	18	5'-0"	2'-8"	5'-0"	2.72	48	51.35
13	18	21	5'-7"	2'-10"	5'-8"	3.17	52	56.28
14	18	24	6'-0"	3'-0"	6'-3"	3.58	60	60.38
15	18	30	7'-0"	3'-2"	7'-6"	4.53	72	68.85
16	21	21	5'-8"	3'-0"	5'-8"	3.20	53	57.19
17	21	24	6'-2"	3'-4"	6'-3"	3.69	61	62.13
18	21	30	7'-2"	3'-6"	7'-6"	4.65	73	70.60
19	24	24	6'-3"	3'-4"	6'-3"	3.67	61	62.40
20	24	30	7'-3"	3'-8"	7'-6"	4.69	74	64.47
21	30	30	7'-6"	4'-0"	7'-6"	4.76	75	73.50

NOTE:

1. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENTS WILL BE BASED ON THE QUANTITIES SHOWN IN ACCOMPANYING TABLE.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

CONCRETE AND FIELDSTONE MASONRY PIPE ENDS FOR COMBINATION PIPES UP TO 30"

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 206.5.0

massDOT Highway Division — Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

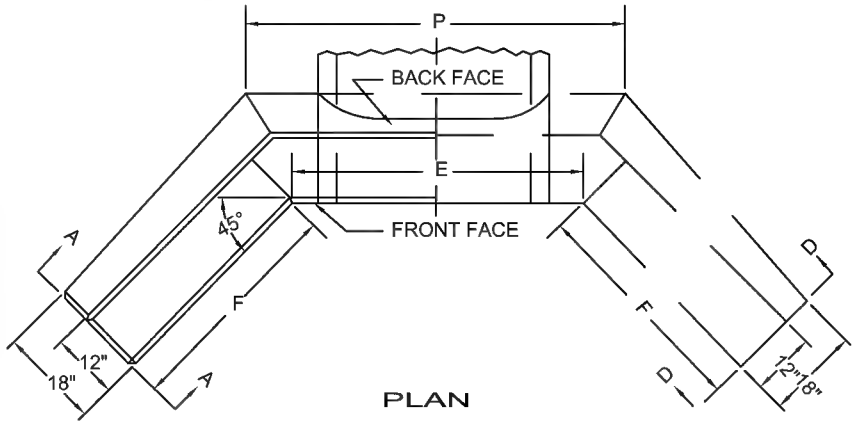
CONCRETE AND FIELDSTONE MASONRY PIPE ENDS FOR 30" TO 84" PIPE

DATE OF ISSUE OCTOBER 2017

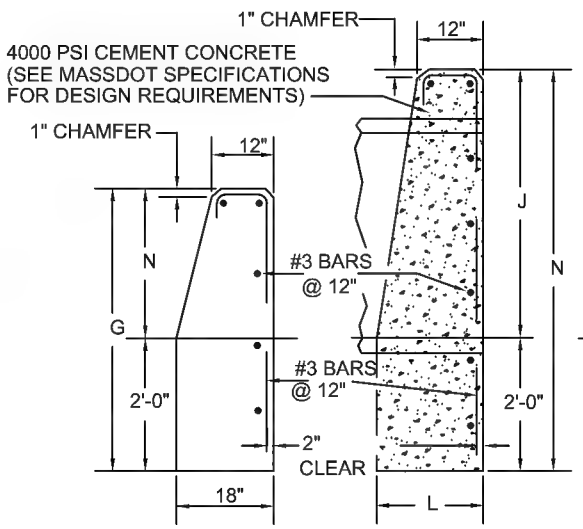
DRAWING NUMBER **E 206.6.0**

NOTE:
1. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE STANDARD SPECIFICATIONS.
2. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENTS WILL BE BASED ON THE QUANTITIES SHOWN IN THE ACCOMPANYING TABLE.

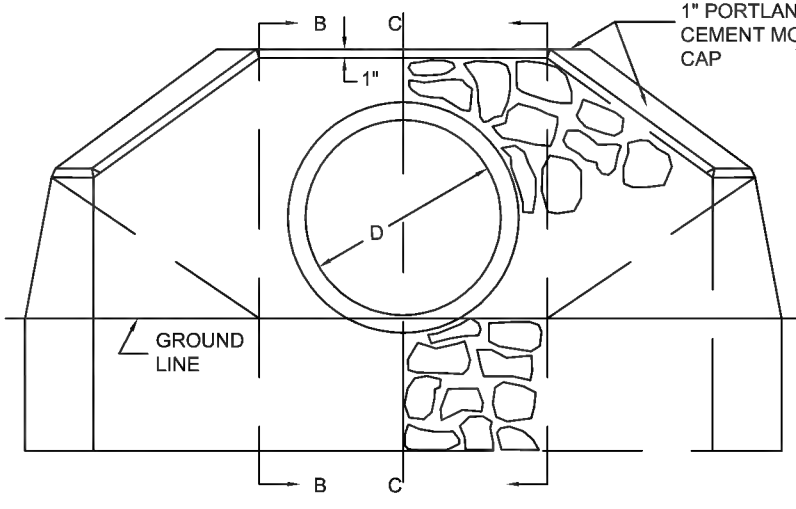
1V:1.5H AND 1V:2H SLOPES								1V:1.5H SLOPE			1V:2H SLOPE			TRENCH EXCAV. FOR 1:2 SLOPE FOR 1'-0" DEPTH CU. FT.
D	E	G	H	J	L	N	P	F	CONC. MASONRY CY	STEEL LBS	F	CONC. MASONRY CY	STEEL LBS	
30"	4'-0"	4'-0"	5'-6"	3'-6"	1'-6"	2'-0"	5'-3"	3'-0"	2.60	45	4'-3"	3.16	54	55.16
36"	4'-6"	4'-3"	6'-0"	4'-0"	1'-8"	2'-3"	5'-11"	3'-6"	3.35	54	5'-0"	4.15	64	64.36
42"	5'-0"	4'-6"	6'-6"	4'-6"	1'-10"	2'-6"	6'-6"	4'-0"	4.20	59	5'-9"	5.25	70	73.70
48"	5'-6"	4'-9"	7'-0"	5'-0"	2'-0"	2'-9"	7'-2"	4'-6"	5.19	65	6'-6"	6.50	83	83.96
54"	6'-0"	5'-0"	7'-6"	5'-6"	2'-2"	3'-0"	7'-10"	5'-0"	6.26	73	7'-3"	7.88	93	94.46
60"	6'-6"	5'-3"	8'-0"	6'-0"	2'-4"	3'-3"	8'-5"	5'-6"	7.43	85	8'-0"	9.37	106	105.30
72"	7'-6"	5'-9"	9'-0"	7'-0"	2'-8"	3'-9"	9'-9"	6'-6"	10.25	98	9'-6"	12.99	128	128.92
84"	8'-6"	6'-3"	10'-0"	8'-0"	3'-0"	4'-3"	11'-0"	7'-6"	13.49	120	11'-0"	17.32	154	153.86



CONCRETE ENDS

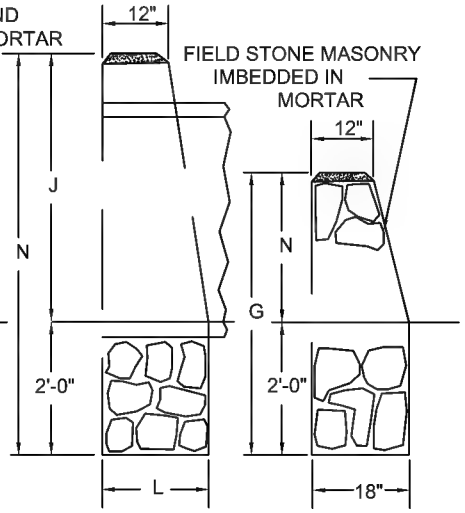


ELEV. A-A SECTION B-B



FRONT ELEVATION

FIELD STONE MASONRY ENDS

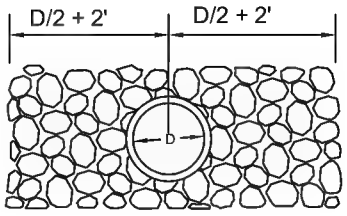


SECTION C-C ELEV. D-D

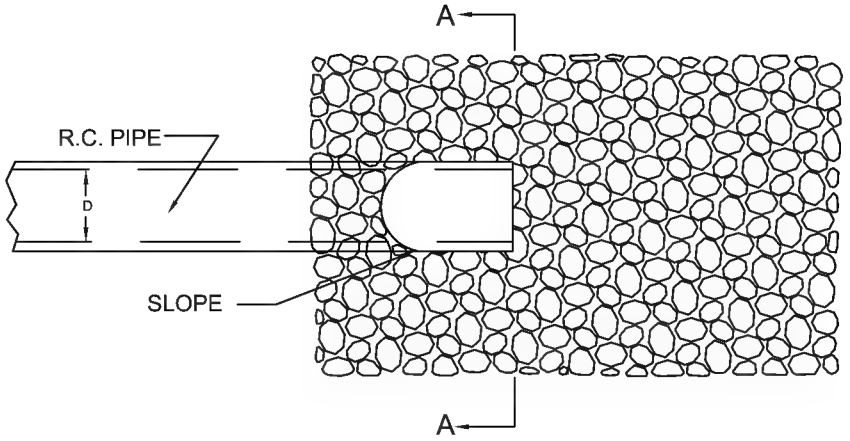
CONSTRUCTION STANDARDS

massDOT Highway Division

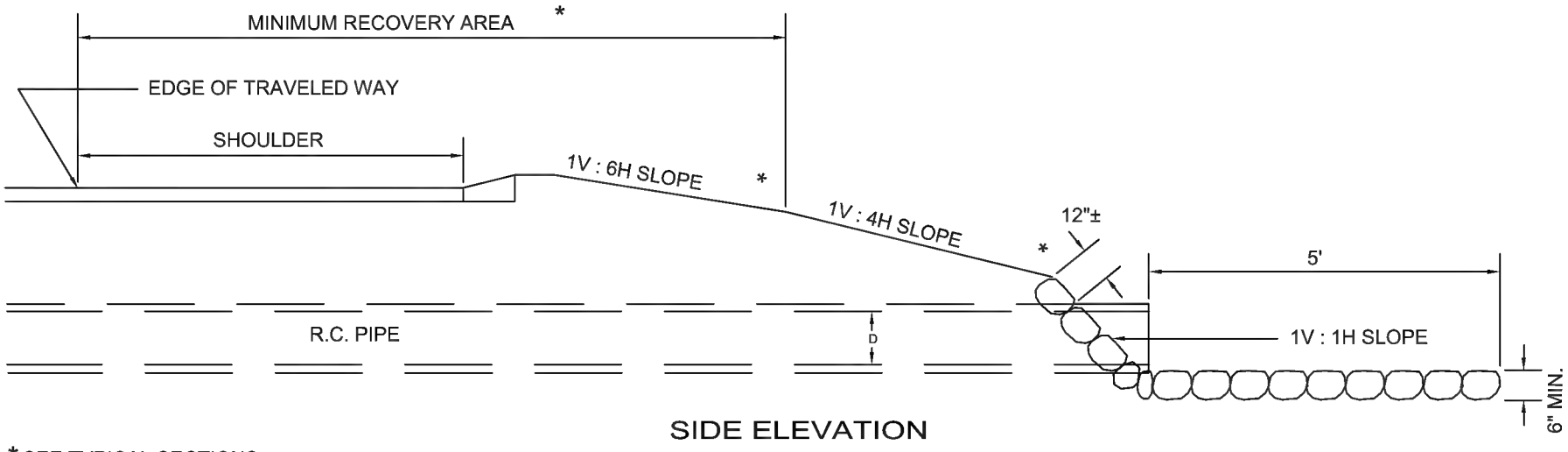
STONE PIPE ENDS FOR PIPES 24" AND LESS IN DIA.



SECTION A-A



PLAN



SIDE ELEVATION

* SEE TYPICAL SECTIONS.

NOTES:

1. STONE TREATMENT OF PIPE ENDS SHALL NOT BE USED IN THE VEHICLE RECOVERY AREA.
2. MINIMUM MASS PER STONE = 50 LBS; MAXIMUM MASS PER STONE = 125 LBS.
3. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

DATE OF ISSUE
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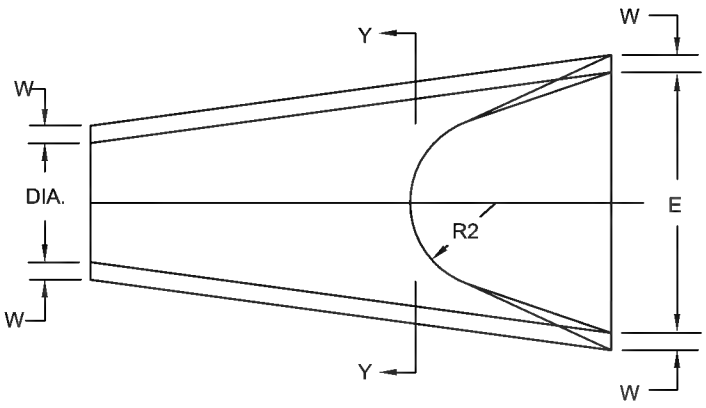
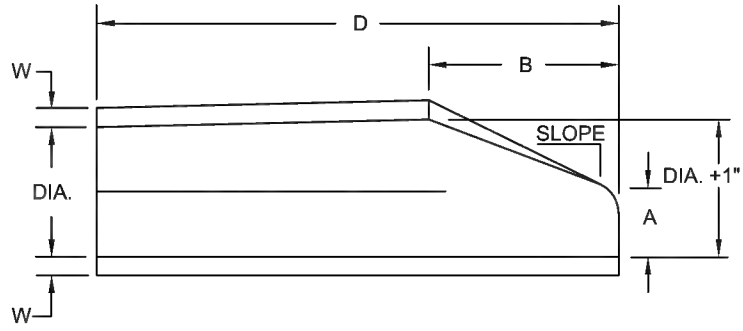
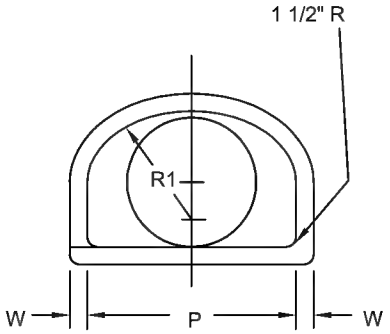


PLAN



SECTION



SECTION Y-Y

TABLE
[ALL DIMENSIONS ARE inches OR feet]

DIAMETER Inch	W	A	B	D	E	P	DIA. +1"	R1	R2	SLOPE
12"	2"	4"	2'-0"	6'-0"	2'-0"	19 15/16"	13"	10 1/8"	9"	1V : 3H
15"	2 1/4"	6"	2'-3"	6'-0"	2'-6"	24 5/16"	16"	12 1/2"	11"	1V : 3H
18"	2 1/2"	9"	2'-3"	6'-0"	3'-0"	29"	19"	15 1/2"	12"	1V : 3H
21"	2 3/4"	9"	2'-11"	6'-0"	3'-6"	31 5/8"	22"	16 1/8"	13"	1V : 3H
24"	3"	9 1/2"	3'-7 1/2"	6'-0"	4'-0"	33 3/16"	25"	16 13/16"	14"	1V : 3H
27"	3 1/4"	10 1/2"	4'-0"	6'-0"	4'-6"	36"	28"	18 9/16"	14 1/2"	1V : 3H
30"	3 1/2"	12"	4'-6"	6'-0"	5'-0"	37"	31"	18 1/2"	15"	1V : 3H
36"	4"	15"	5'-3"	8'-0"	6'-0"	47 13/16"	37"	24 5/16"	20"	1V : 3H
42"	4 1/2"	21"	5'-3"	8'-0"	6'-6"	53 7/8"	43"	27 1/2"	22"	1V : 3H
48"	5"	24"	6'-0"	8'-0"	7'-0"	56 1/2"	49"	28 1/2"	22"	1V : 3H

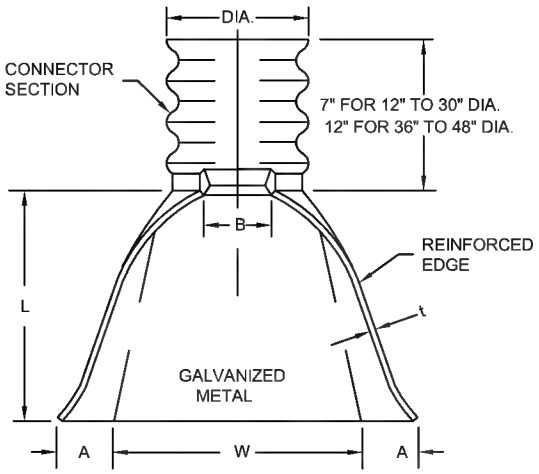
NOTES:
1. SEE STANDARD SPECIFICATIONS FOR THE TYPE OF PIPE TO BE USED (BELL & SPIGOT OR TONGUE & GROOVE)
2. SEE STANDARD SPECIFICATIONS FOR THE TYPE OF PIPE AND PLACING OF STEEL REINFORCEMENT.
3. THE JOINTS ARE TO BE COMPATIBLE WITH THE MAIN RUN OF PIPE.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

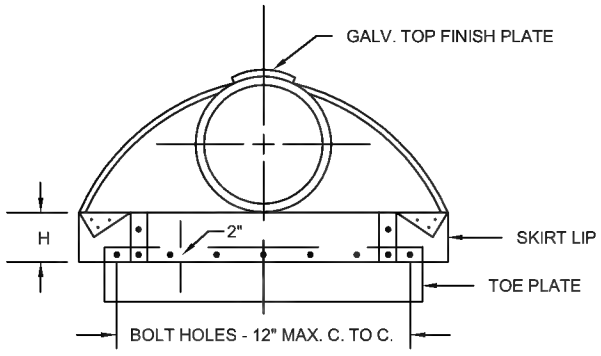
REINFORCED CONCRETE PIPE FLARED ENDS

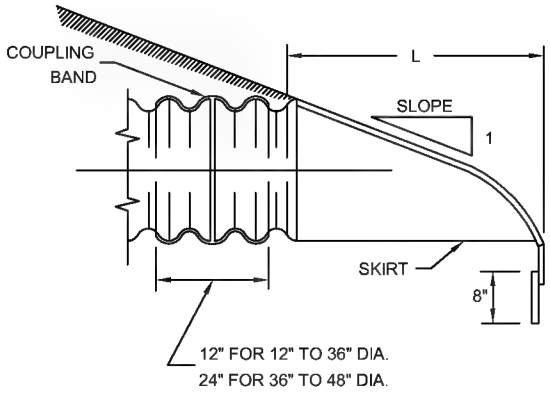
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 206.8.0

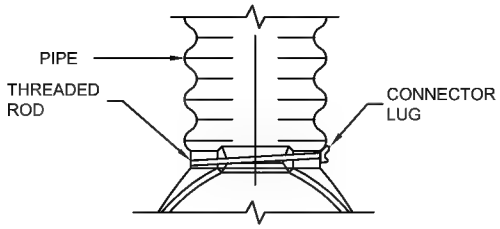


PIPE DIA. (IN)	GA.	DIMENSIONS (IN.)					APPROX. SLOPE
		A (± 1")	B (MAX.)	H (± 1")	L (±1 1/2")	W (± 2")	
12	16	6	6	6	21	24	1V : 2.5H
15	16	7	8	6	26	30	1V : 2.5H
18	16	8	10	6	31	36	1V : 2.5H
21	16	9	12	6	36	42	1V : 2.5H
24	16	10	13	6	41	48	1V : 2.5H
30	14	12	16	8	51	60	1V : 2.5H
36	14	14	19	9	60	72	1V : 2.5H
42	12	16	22	11	39	84	1V : 2.5H
48	12	18	27	12	78	90	1V : 2.25H

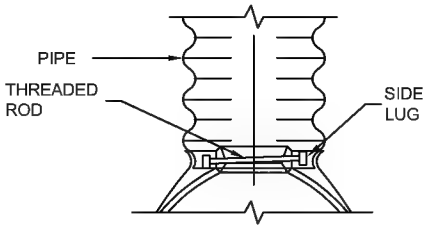




ALTERNATE CONNECTIONS



FOR 12" TO 24" ONLY



FOR 30" AND 36" ONLY

NOTES:

1. TOE PLATE TO BE PUNCHED TO MATCH HOLES IN SKIRT LIP. 3/8" Ø GALVANIZED BOLTS TO BE FURNISHED. LENGTH OF TOE PLATE TO BE W+10" FOR 12" TO 30" DIA. PIPE AND W+22" FOR 36" TO 48" DIA.
2. SKIRT SECTION FOR 12" TO 24" DIA. PIPE TO BE MADE IN ONE PIECE. SKIRT SECTION FOR 12" TO 30" DIA. PIPE MAY BE MADE FROM TWO SHEETS JOINED BY RIVETING OR BOLTING ON CENTER LINE WITH 3/8" DIA. FASTENERS.
3. CONNECTOR SECTION, TOE PLATE AND SKIRT TO BE OF SAME THICKNESS METAL; EACH TO BE GALVANIZED AND COATED WITH A TAR BASE PAINT.
4. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHOD, SEE LATEST STANDARD SPECIFICATIONS.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

STANDARD METAL END

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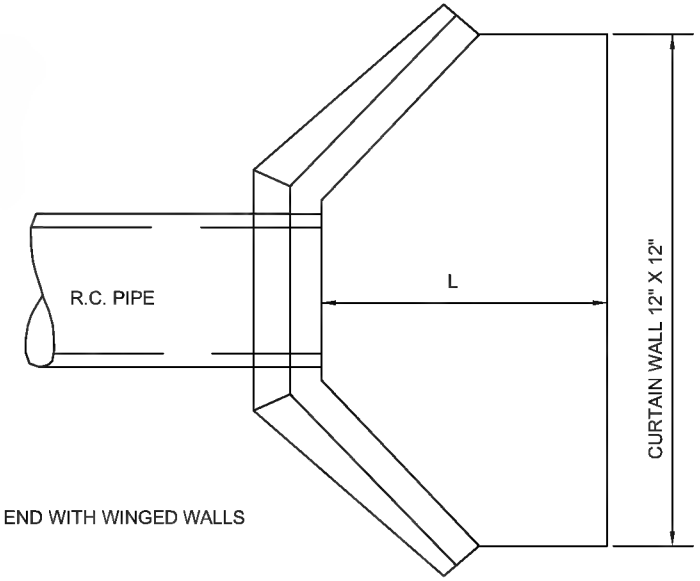
CONSTRUCTION STANDARDS

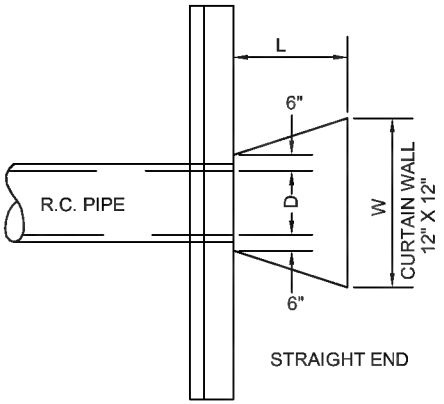
massDOT Highway Division
Massachusetts Department of Transportation

CONCRETE SPLASH PADS



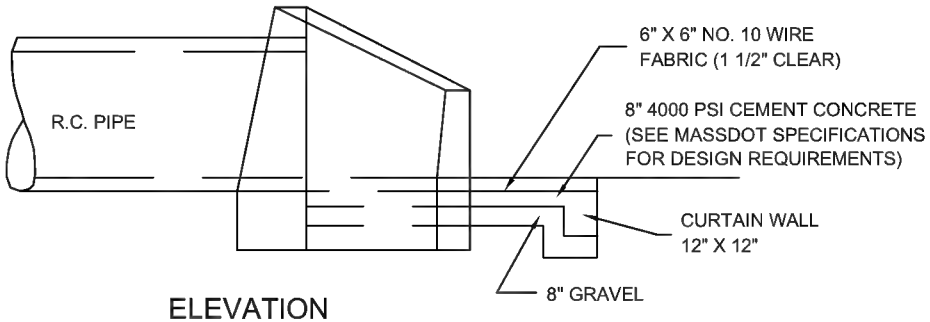
END WITH WINGED WALLS

PLAN

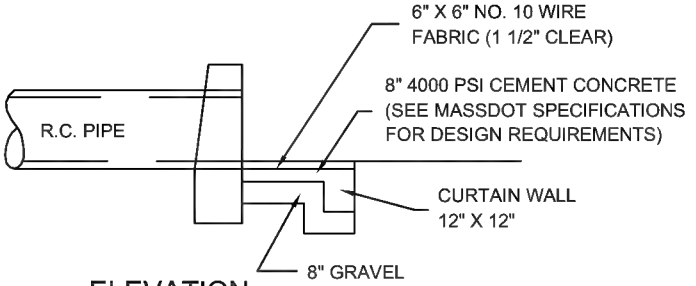


STRAIGHT END

PLAN



ELEVATION



ELEVATION

PIPE DIAM. (IN)	36	42	48	54	60	66	72	84
L (FT)	6	7	8	9	10	11	12	14

PIPE DIAM. (IN)	12	15	18	21	24	30
L	3'-0"	3'-0"	3'-0"	3'-6"	4'-0"	5'-0"
W	4'-0"	4'-0"	4'-6"	5'-3"	6'-0"	7'-6"

NOTE:
1) ALL PIPE DIAMETERS NOMINAL SIZE

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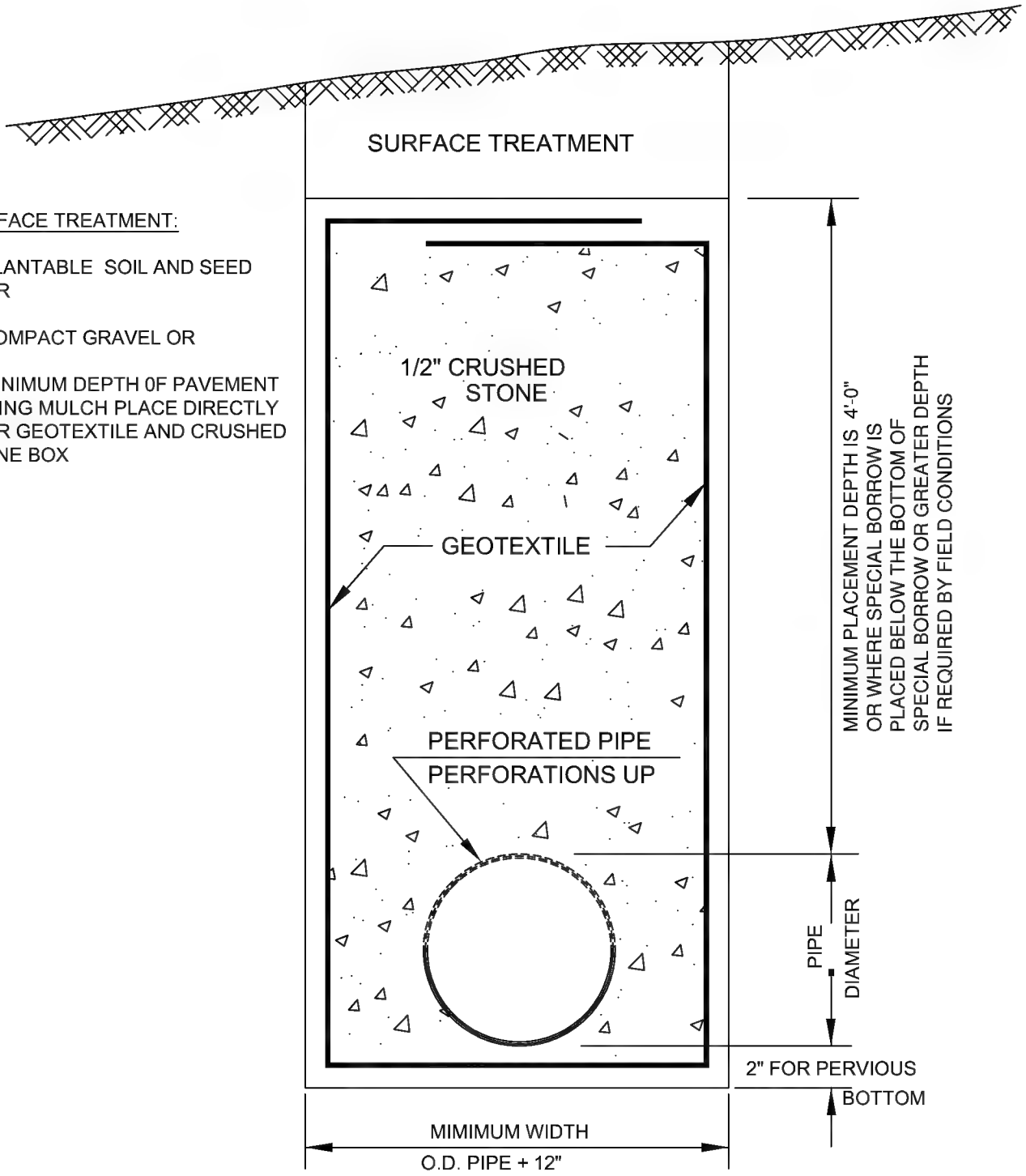
E 208.1.0



SURFACE TREATMENT:

4" PLANTABLE SOIL AND SEED OVER

8" COMPACT GRAVEL OR

4" MINIMUM DEPTH 0F PAVEMENT MILLING MULCH PLACE DIRECTLY OVER GEOTEXTILE AND CRUSHED STONE BOX

NOTES:

1. GEOTEXTILE FABRIC AS DESCRIBED IN SECTION M9.50

2. PIPE SHALL BE SET AT BOTTOM OF TRENCH FOR IMPERVIOUS BOTTOM.

3. SUBDRAIN LOCATED APPROXIMATELY AT INTERSECTION OF TANGENTS (SEE DWG. E102.1.0)

4. GRAVEL (AND SPECIAL BORROW WHERE REQUIRED) SHALL INTERSECT CRUSHED STONE FOR SUBDRAIN

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

SUBDRAIN

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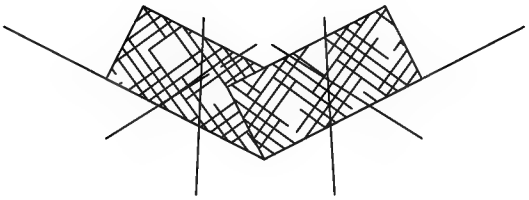
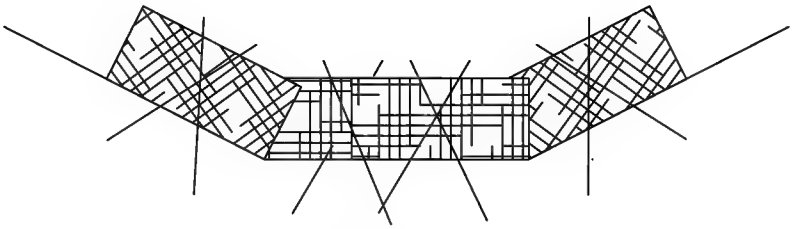


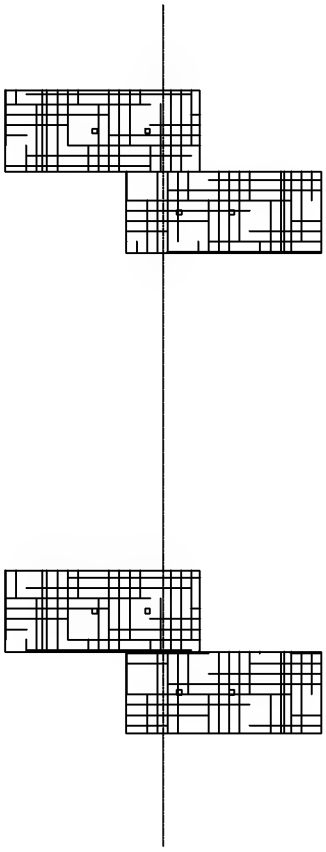
V DITCH

CROSS SECTION



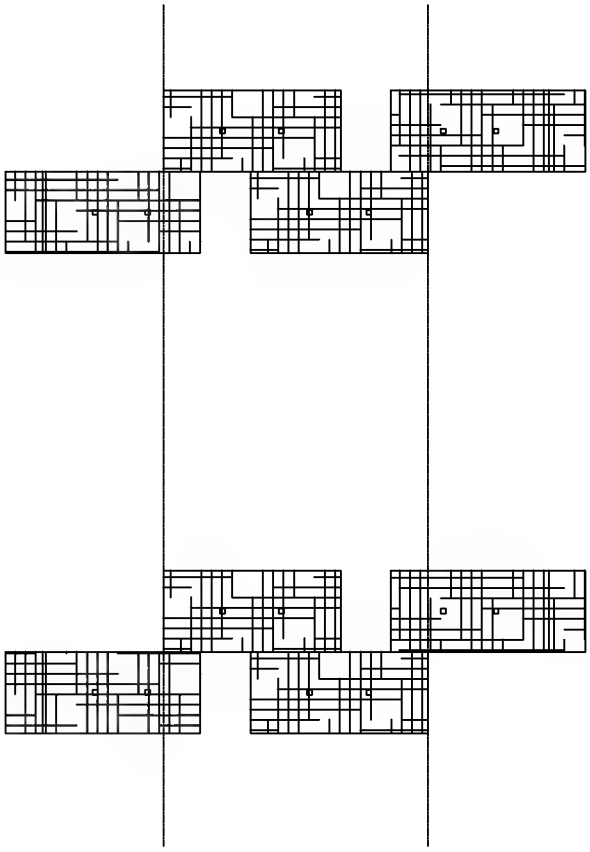
FLAT DITCH

CROSS SECTION



V DITCH

PLAN



FLAT DITCH

PLAN

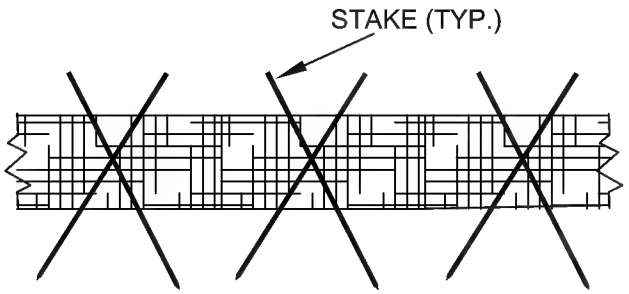
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

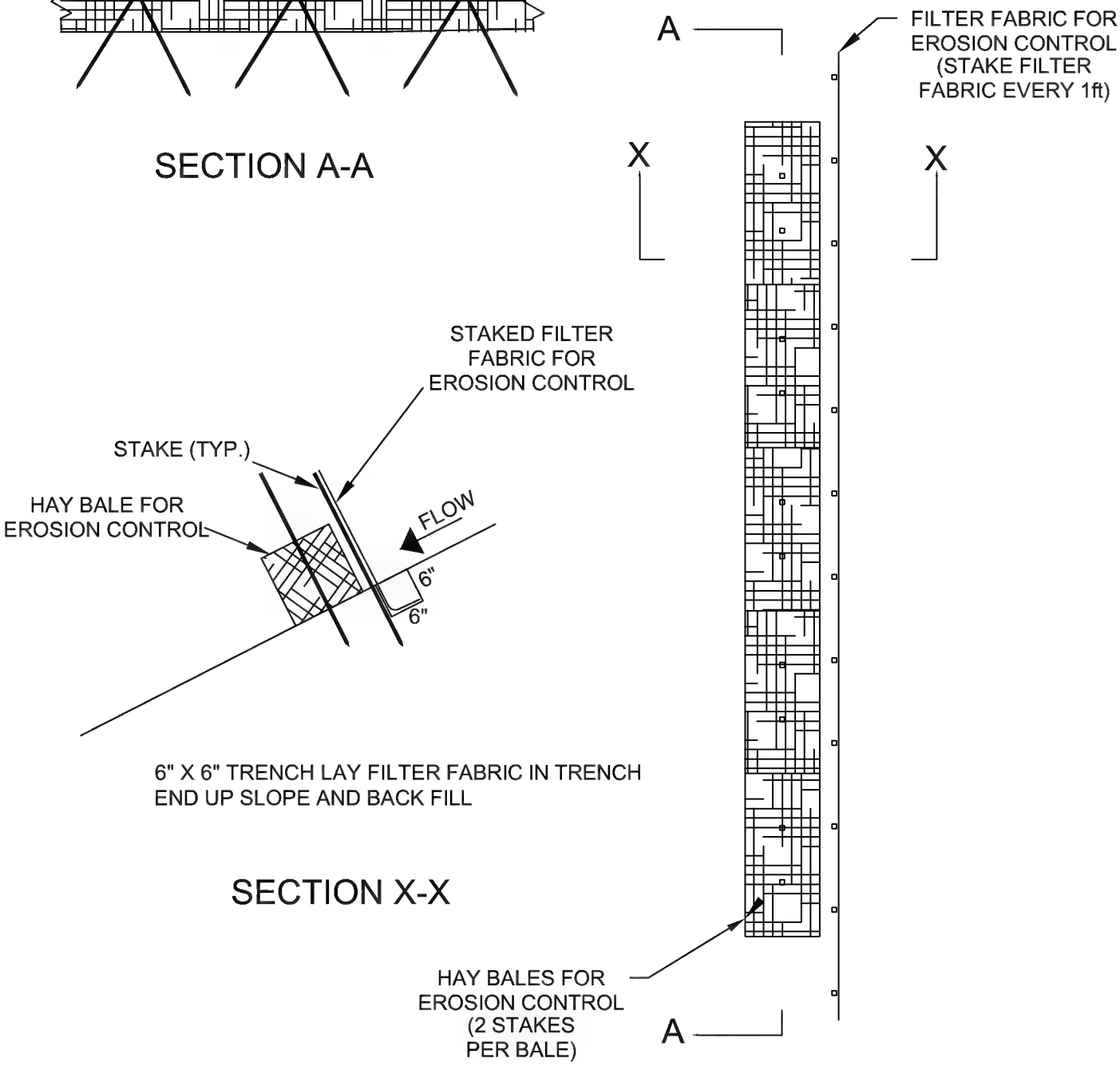
DITCH CHECK DAMS FOR EROSION CONTROL

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 210.2.0



SECTION A-A



6" X 6" TRENCH LAY FILTER FABRIC IN TRENCH
END UP SLOPE AND BACK FILL

SECTION X-X

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

HAY BALES AND SILT FENCES FOR EROSION CONTROL

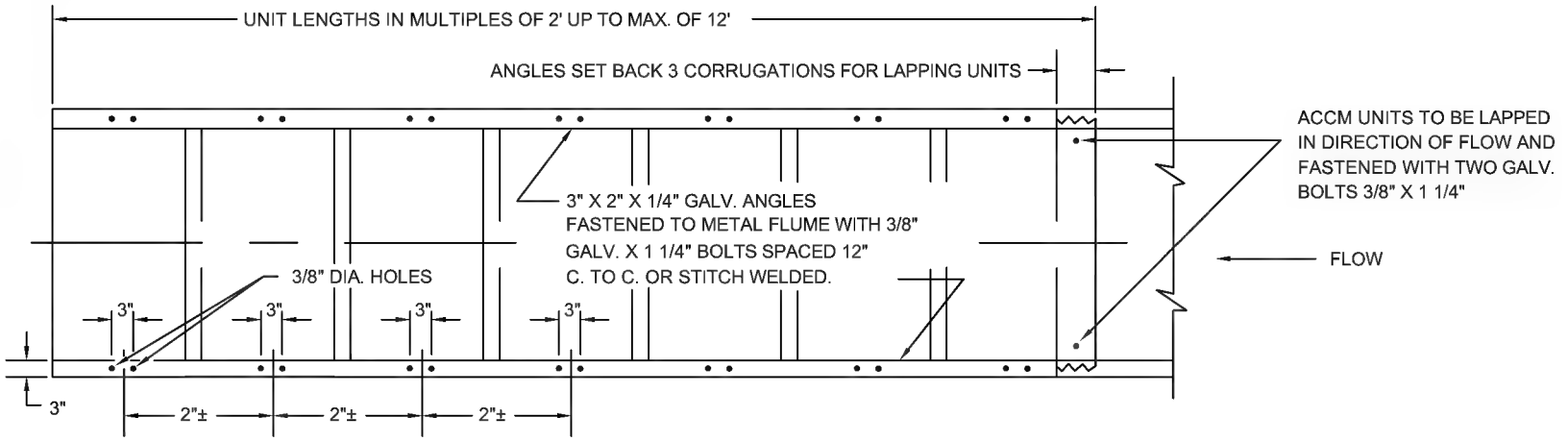
DATE OF ISSUE
OCTOBER 2017

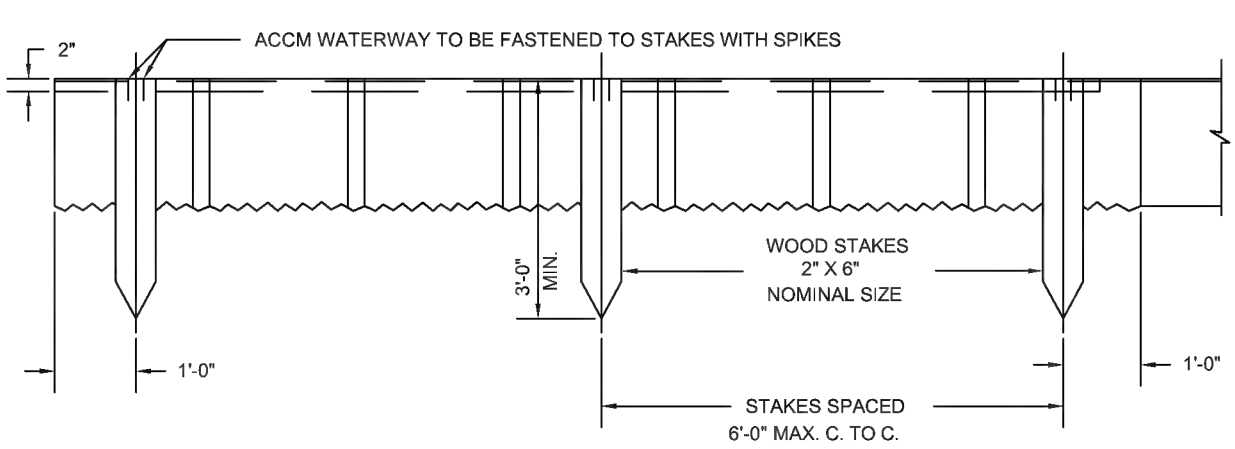
DRAWING NUMBER
E 210.3.0

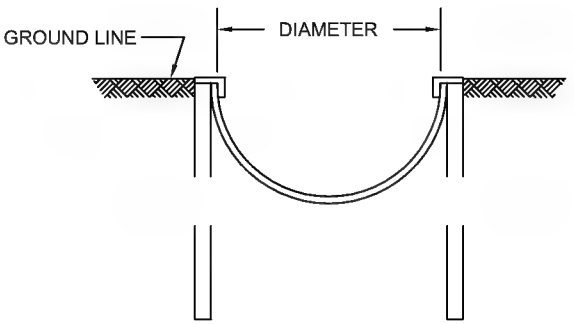
CONSTRUCTION STANDARDS

massDOT Highway Division

HALF CIRCLE CCM PIPE WATERWAYS







NOTE:

1. DIAMETER OF HALF CCM PIPE WATERWAY TO BE AS SPECIFIED.
2. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

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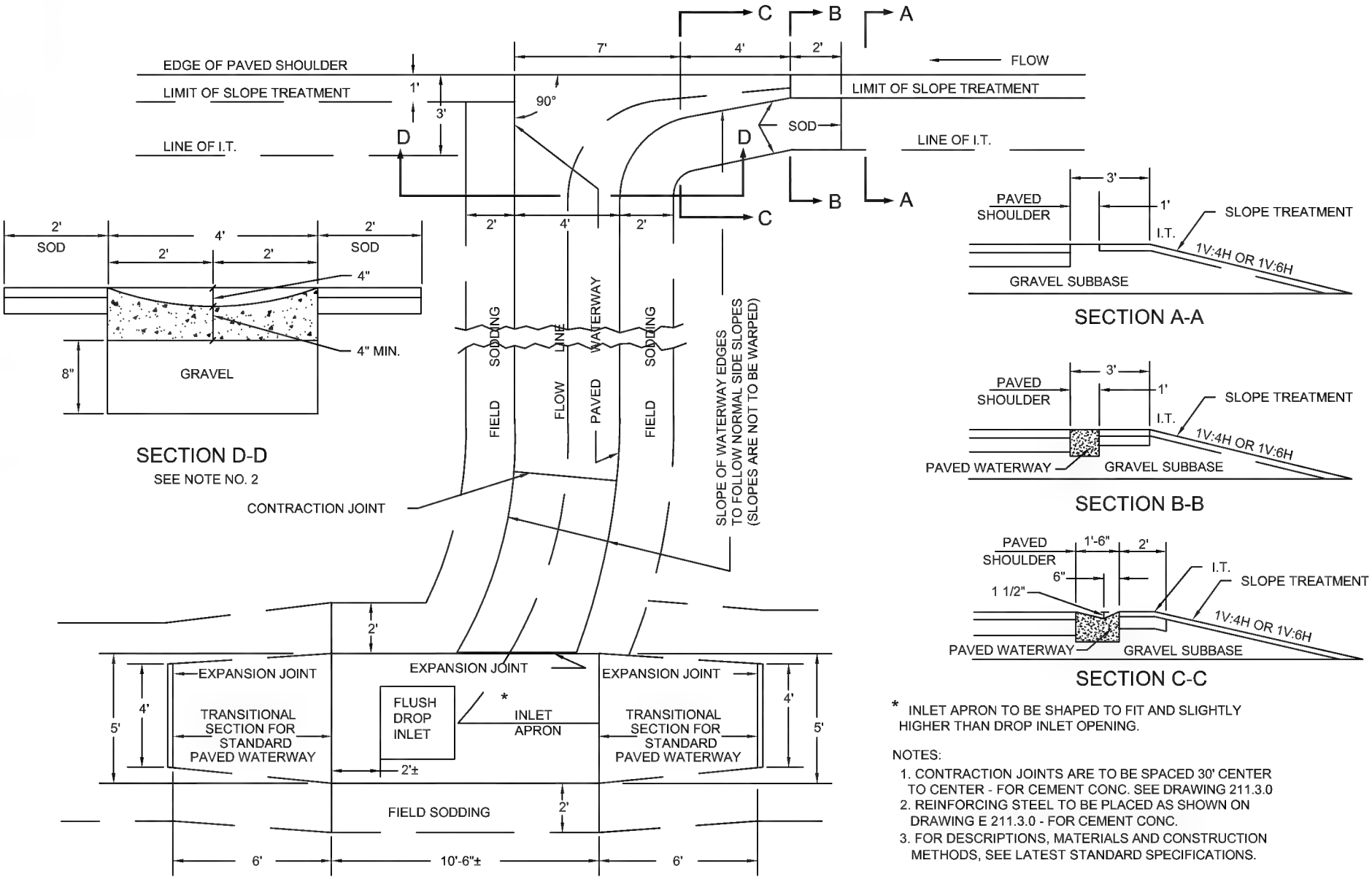
E 211.1.0

CONSTRUCTION STANDARDS

massDOT Highway Division

PAVED WATERWAYS AND APRON



SECTION D-D

SEE NOTE NO. 2

SECTION A-A

SECTION B-B

SECTION C-C

* INLET APRON TO BE SHAPED TO FIT AND SLIGHTLY HIGHER THAN DROP INLET OPENING.

NOTES:

1. CONTRACTION JOINTS ARE TO BE SPACED 30' CENTER TO CENTER - FOR CEMENT CONC. SEE DRAWING 211.3.0
2. REINFORCING STEEL TO BE PLACED AS SHOWN ON DRAWING E 211.3.0 - FOR CEMENT CONC.
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.

DATE OF ISSUE
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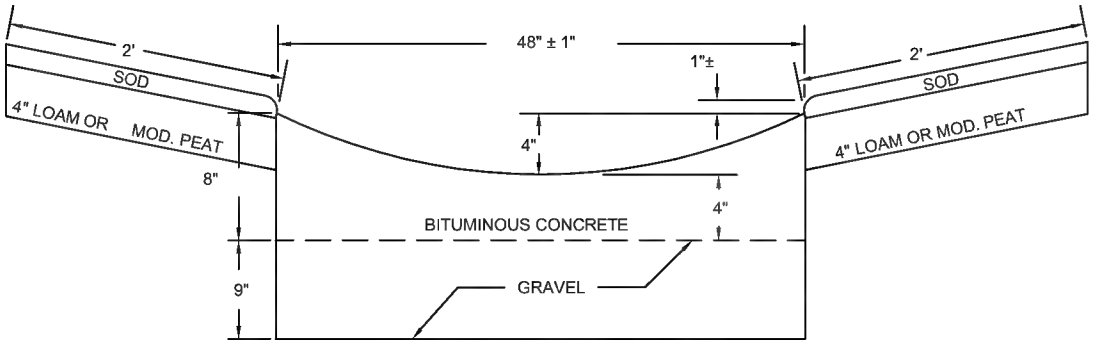
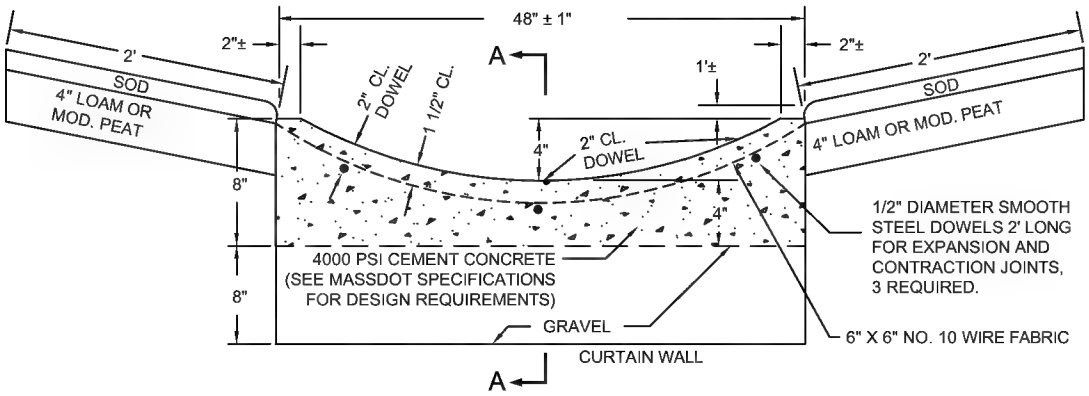
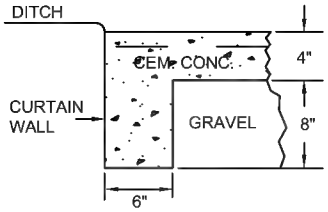
DRAWING NUMBER
E 211.2.0



BITUMINOUS CONCRETE

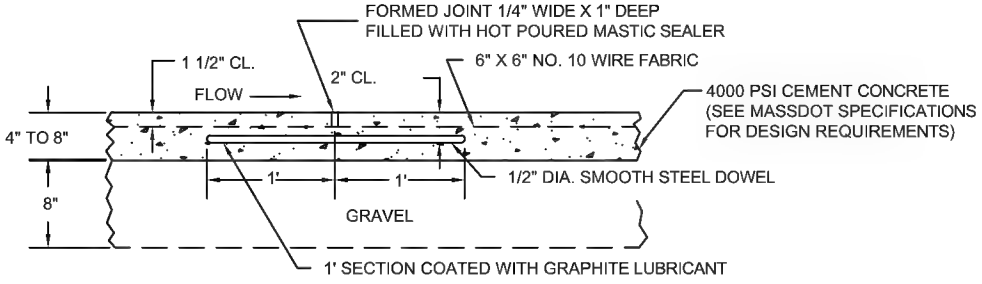


CEMENT CONCRETE



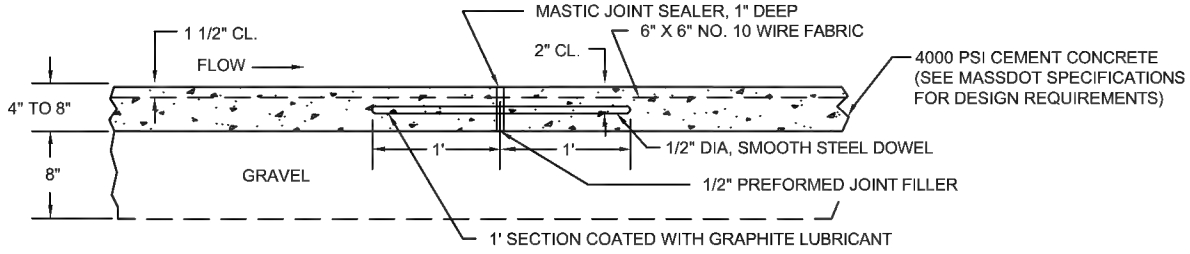
CURTAIN WALL TO BE INSTALLED AT TERMINI OF PAVING

SECTION A-A



CONTRACTION JOINT TO BE PLACED 30' MAXIMUM CENTER TO CENTER

DETAILS OF CONTRACTION JOINTS



EXPANSION JOINTS TO BE INSTALLED AT APPROACHES TO STRUCTURES

DETAILS OF EXPANSION JOINTS

NOTES:

1. ON CURVED ALIGNMENT, WATERWAYS SHALL BE BANKED AS DIRECTED.
2. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS, SEE LATEST STANDARD SPECIFICATIONS.

massDOT Massachusetts Department of Transportation Highway Division

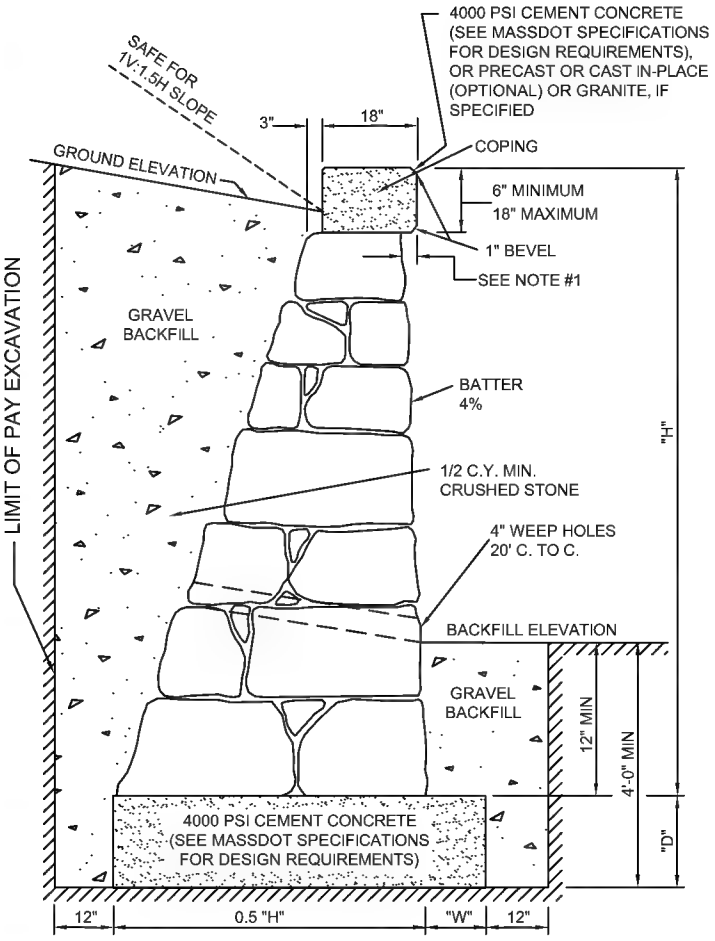
CONSTRUCTION STANDARDS

PAVED WATERWAYS

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 211.3.0

H (FT)	W (FT)	D (FT)	CONCRETE MASONRY FOOTING		STONE MASONRY EXCLUDING COPING	
			SECTION AREA (SQ. FT.)	VOLUME PER UNIT LENGTH (CU.YD./LIN.FT)	SECTION AREA (SQ. FT.)	VOLUME PER UNIT LENGTH (CU.YD./LIN.FT)
5.0	0.75	1.25	4.06	0.150	9.00	0.333
5.5			4.38	0.162	10.63	0.394
6.0			4.69	0.174	12.38	0.458
6.5			5.00	0.185	14.16	0.524
7.0			5.31	0.197	16.05	0.594
7.5			5.63	0.208	18.06	0.669
8.0	1.0	1.5	7.50	0.278	20.16	0.747
8.5			7.88	0.292	22.40	0.829
9.0			8.25	0.306	24.75	0.917
9.5			8.63	0.319	27.22	1.008
10.0	1.2	2.0	12.40	0.459	29.80	1.104
10.5			12.90	0.478	32.50	1.204
11.0			13.40	0.496	35.28	1.307
11.5			13.90	0.515	38.21	1.415
12.0			14.40	0.533	41.25	1.528
12.5			14.90	0.552	44.41	1.645
13.0	1.5	2.5	20.00	0.741	47.68	1.766
13.5			20.63	0.764	51.07	1.891
14.0			21.25	0.787	54.53	2.020
14.5			21.88	0.810	58.14	2.153
15.0			22.50	0.833	61.88	2.292
15.5			23.13	0.856	65.72	2.434
16.0			23.75	0.880	69.68	2.581
16.5	1.8	3.0	30.15	1.117	73.76	2.732
17.0			30.90	1.144	77.90	2.885
17.5			31.65	1.172	82.21	3.045
18.0			32.40	1.200	86.63	3.208
18.5			33.15	1.228	91.38	3.384
19.0			33.90	1.256	96.25	3.565
19.5			34.65	1.283	101.25	3.750
20.0			35.40	1.311	106.38	3.940
20.5			36.15	1.339	111.63	4.134
21.0			36.90	1.367	117.00	4.333
21.5			37.65	1.394	122.50	4.537
22.0			38.40	1.422	128.13	4.745
22.5			39.15	1.450	133.88	4.958
23.0			39.90	1.478	139.75	5.176
23.5			40.65	1.506	145.75	5.398
24.0			41.40	1.533	151.88	5.625
24.5			42.15	1.561	158.13	5.856
25.0			42.90	1.589	164.50	6.093
25.5			43.65	1.617	171.00	6.333
26.0			44.40	1.644	177.63	6.579
26.5			45.15	1.672	184.38	6.829



COPING TO BE PRECAST CONCRETE OR GRANITE OF UNIFORM DEPTH FOR THE ENTIRE LENGTH. DEPTH OF CONCRETE TO BE 1/12 THE AVERAGE "H" WITHIN THE LIMITS SHOWN. DEPTH OF GRANITE TO BE AS SHOWN ON THE PLANS, 6" OR 9".

FOR CHAIN LINK FENCE ON TOP OF WALL, THE COPING SHALL BE CONCRETE CAST-IN-PLACE WITH A MINIMUM DEPTH OF 12". THE LENGTH OF GALVANIZED PIPE SLEEVES FOR FENCE POSTS SHALL BE EQUAL TO THE DEPTH OF COPING.

NOTES:

1. COPING OVERHANG TO BE APPROXIMATELY 3" FOR WALLS 10' OR MORE IN HEIGHT AND APPROXIMATELY 2" FOR WALLS LESS THAN 10' IN HEIGHT; IN A CONTINUOUS WALL OF VARYING HEIGHT THE OVERHANG WILL BE APPROXIMATELY 2" TO 3" FOR THE ENTIRE LENGTH.
2. ALL DIMENSIONS SHOWN ARE MINIMUM.
3. PAYMENT WILL BE BASED ON THE ACCOMPANYING TABLE.
4. TO BE FOUNDED ON SUITABLE SOIL

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

CEMENTED STONE MASONRY WALL

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 302.2.0

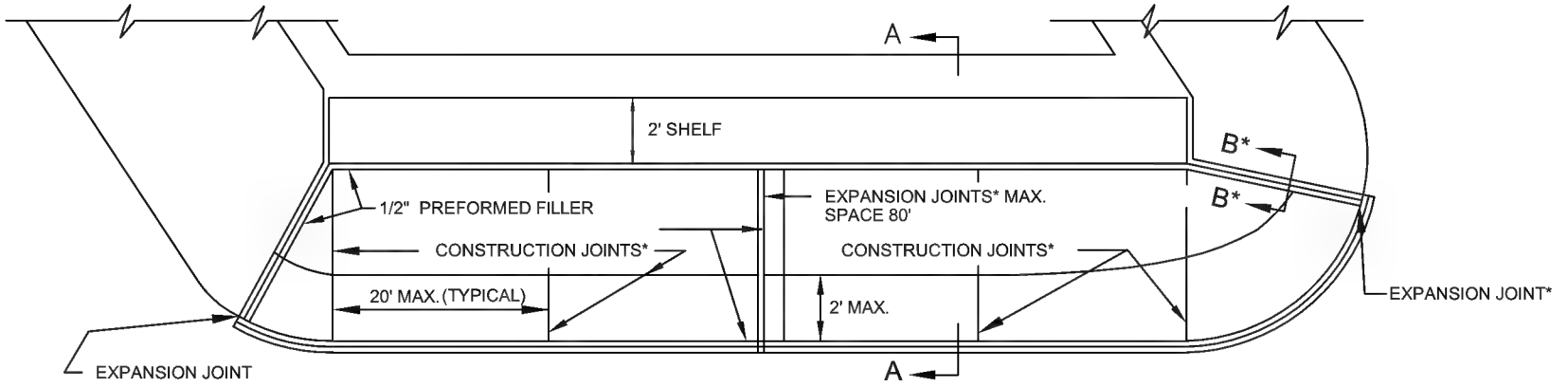
CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

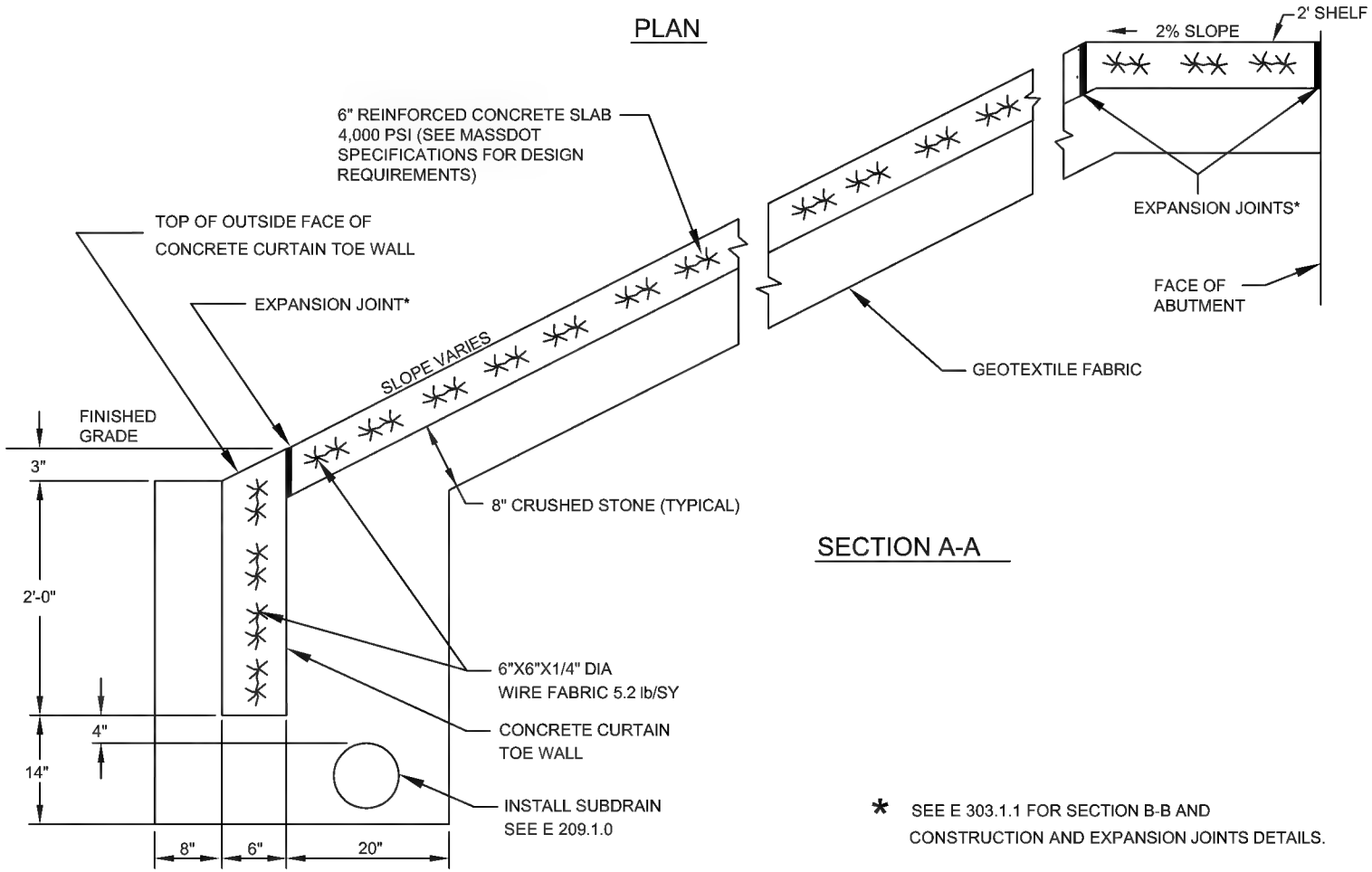
SPECIAL SLOPE PAVING UNDER BRIDGES REINFORCED CONCRETE SLAB

DRAWING NUMBER
E 303.1.0

DATE OF ISSUE
OCTOBER 2017



PLAN



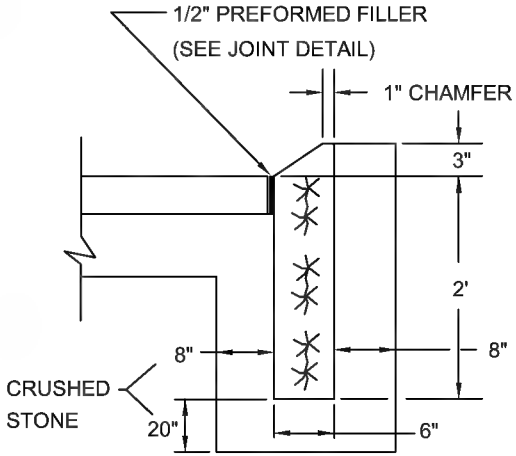
SECTION A-A

* SEE E 303.1.1 FOR SECTION B-B AND CONSTRUCTION AND EXPANSION JOINTS DETAILS.

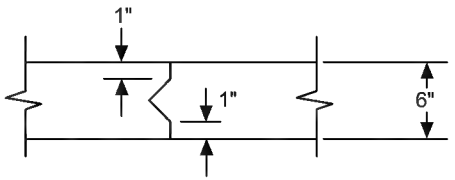
CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

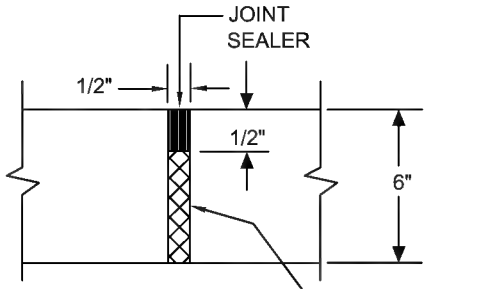
SPECIAL SLOPE PAVING UNDER BRIDGES REINFORCED CONCRETE SLAB DETAILS



CURTAIN WALL ON SIDES
OF SLABS SECTION B-B



CONSTRUCTION
JOINT DETAIL



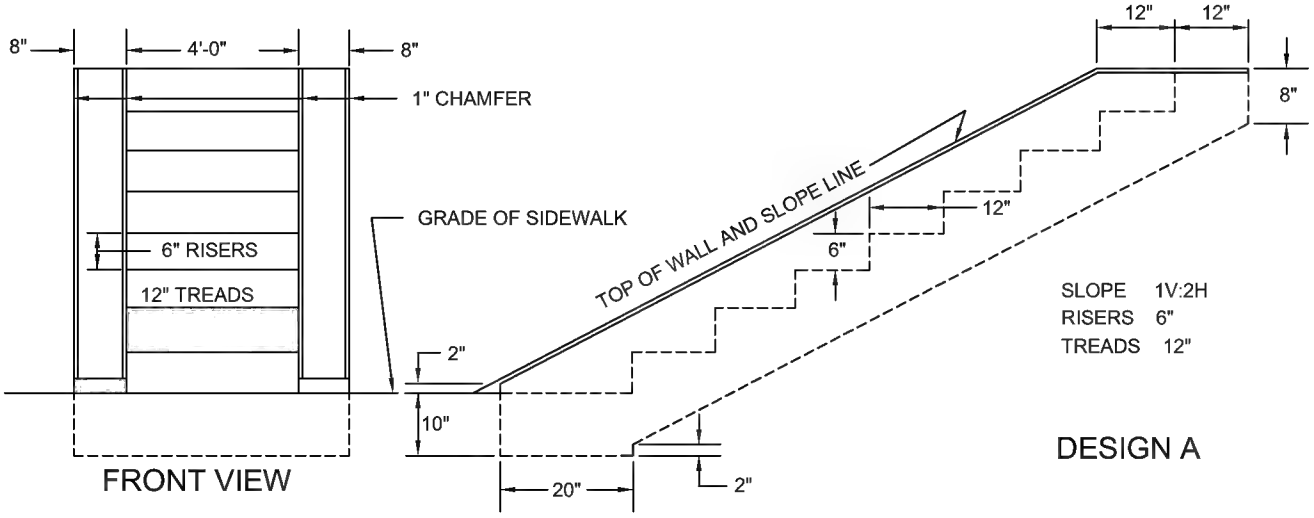
EXPANSION
JOINT DETAIL

NOTES:

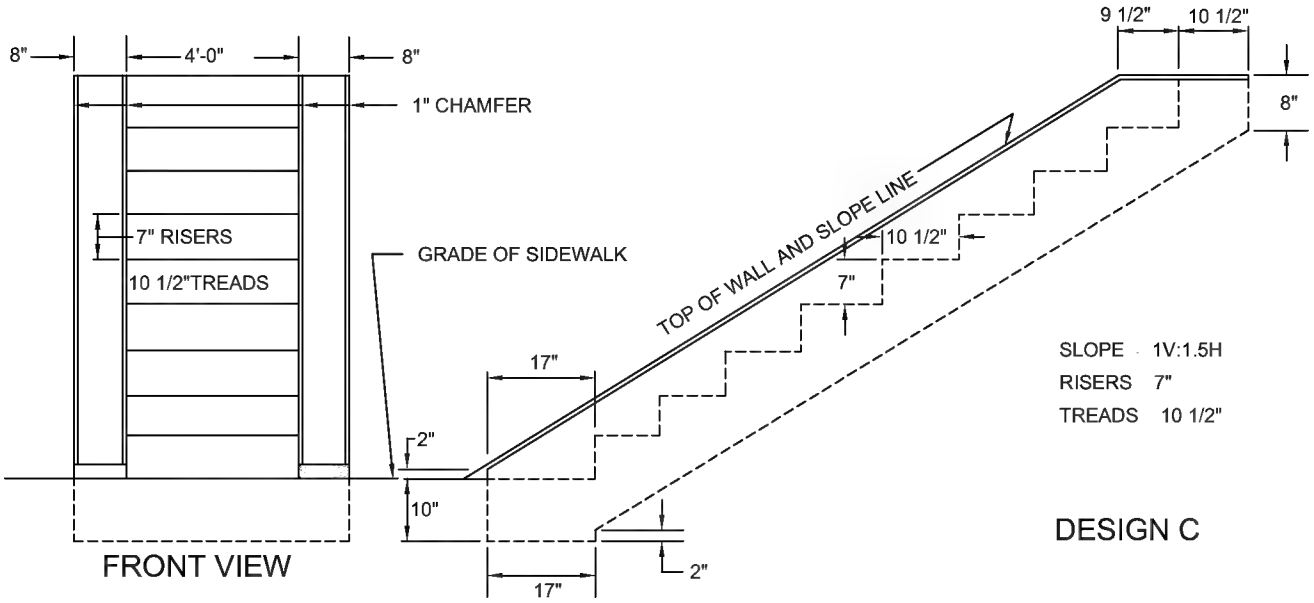
1. WIRE FABRIC TO HAVE 12" MINIMUM LAP AT SPLICE AND SHOULD EXTEND WITHIN 3" OF ALL EDGES
2. SLAB SHALL BE GROOVED PARALLEL TO AND NORMAL TO THE CURTAIN TOE WALL AT APPROXIMATELY 6' GRIDS. THE GROOVE DEPTH SHALL BE 1"
3. FOR LIMITS OF SLOPE PAVING SEE BRIDGE MANUAL.
4. CONCRETE SHALL BE 4,000 PSI (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
5. EXTEND GEOTEXTILE FABRIC BENEATH CRUSHED STONE FROM TOP OF CONCRETE CURTAIN TOE WALL TO FACE OF ABUTMENT.
6. SEE E 303.1.0 FOR SLAB PLAN AND SECTION.

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 303.1.1



PLEASE NOTE: DESIGN B HAS BEEN DISCONTINUED

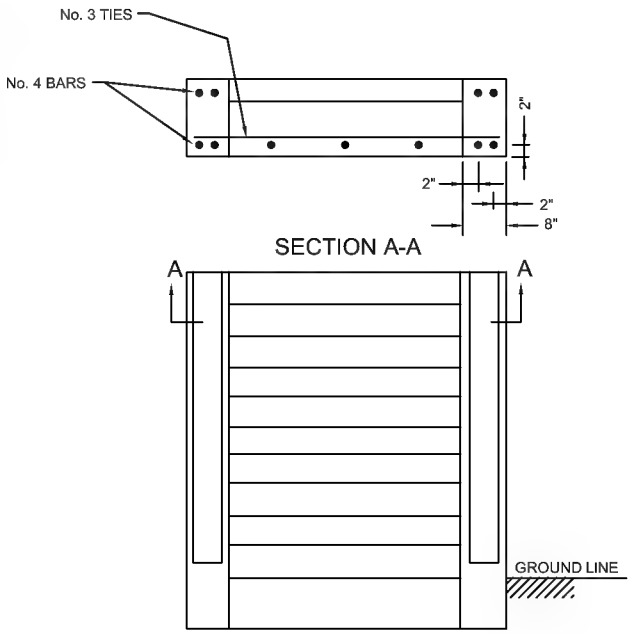


NOTES:

1. ALL CONCRETE DIMENSIONS SHOWN ARE MINIMUM EXCEPT RISERS AND TREADS WHICH HAVE 1/4" TOLERANCE.
2. FOR REINFORCING STEEL AND CONCRETE QUANTITIES SEE DRAWING E 304.2.0

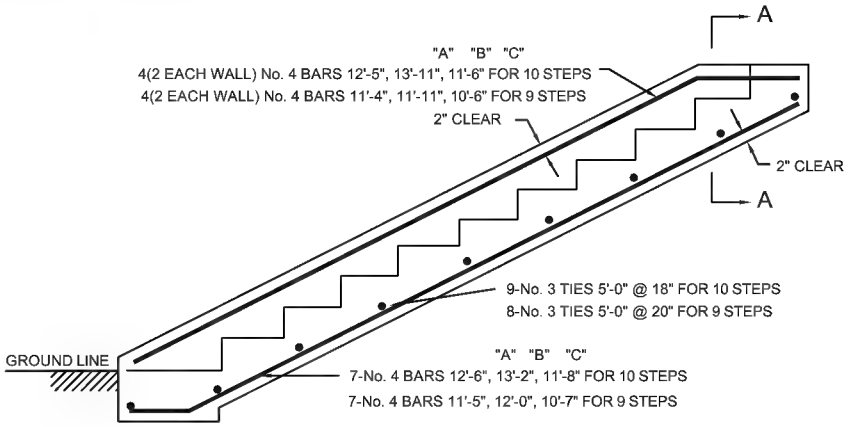
CEMENT CONCRETE STEPS

2/2



FRONT VIEW

NOTES:
1. FOR DESCRIPTIONS , MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.
2. PAYMENT WILL BE BASED ON THE QUANTITIES SHOWN IN THE ACCOMPANYING TABLES.
3. RAILING AS REQUIRED BY AAB AND STATE BUILDING CODE



SIDE VIEW

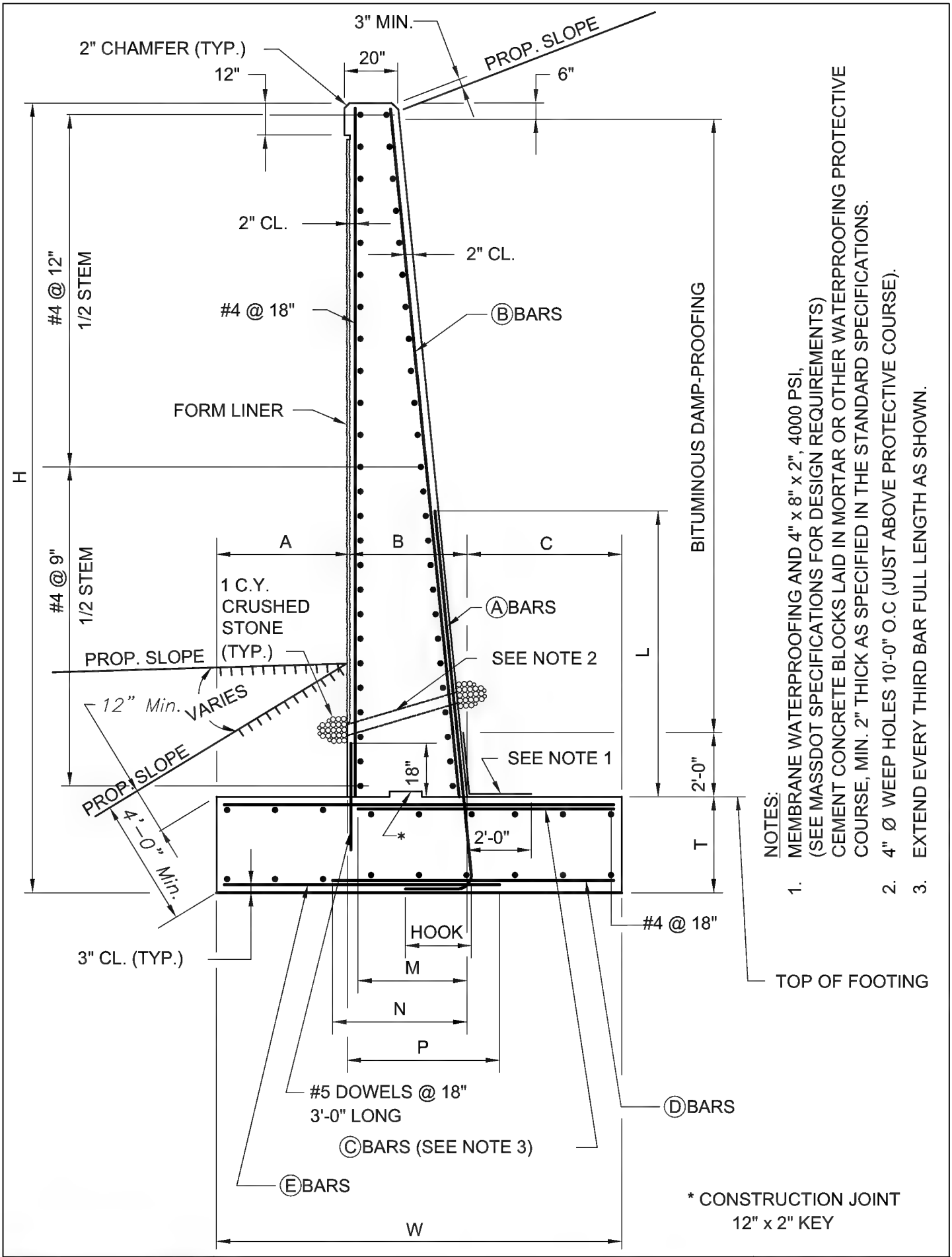
FOR DESIGNS "A", "B" AND "C" SEE DRAWING E 304.1.0

STEP NOS.	DESIGN A						DESIGN C					
	QUANTITIES - CU. FT.				TOTAL C.Y.	REINF. STEEL LBS	QUANTITIES - CU. FT.				TOTAL C.Y.	REINF. STEEL LBS
	BASE	STEPS	2-WALLS	TOTAL			BASE	STEPS	2-WALLS	TOTAL		
2	5.55	7.33	6.26	19.15	0.71	--	4.72	6.71	5.65	17.08	0.63	--
3	5.55	11.00	8.48	25.03	0.93	--	4.72	10.06	7.69	22.48	0.83	--
4	5.55	14.66	10.70	30.92	1.15	--	4.72	13.42	9.73	27.87	1.03	--
5	5.55	18.33	12.92	36.81	1.36	--	4.72	16.77	11.78	33.27	1.23	--
6	5.55	22.00	15.15	42.70	1.58	--	4.72	20.12	13.82	38.66	1.43	--
7	5.55	25.66	17.37	48.59	1.80	--	4.72	23.48	15.86	44.06	1.63	--
8	5.55	29.33	19.59	54.47	2.02	--	4.72	26.83	17.90	49.46	1.83	--
9	5.55	33.00	21.81	60.36	2.24	99	4.72	30.19	19.94	54.85	2.03	92
10	5.55	36.66	24.03	66.25	2.45	109	4.72	33.54	22.00	60.25	2.23	102

ALL CONCRETE SHALL BE 4,000 PSI (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

PLEASE NOTE: DESIGN B HAS BEEN DISCONTINUED

DATE OF ISSUE
OCTOBER 2017
DRAWING NUMBER
E 304.2.0



NOTES:

1. MEMBRANE WATERPROOFING AND 4" x 8" x 2", 4000 PSI, (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS) CEMENT CONCRETE BLOCKS LAID IN MORTAR OR OTHER WATERPROOFING PROTECTIVE COURSE, MIN. 2" THICK AS SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. 4" Ø WEEP HOLES 10'-0" O.C (JUST ABOVE PROTECTIVE COURSE).
3. EXTEND EVERY THIRD BAR FULL LENGTH AS SHOWN.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

TYPICAL CANTILEVER RETAINING WALL SECTION

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 305.1.0

massDOT Highway Division — Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CANTILEVER RETAINING WALLS
DENSE FOUNDATION SOILS,
SLOPING BACKFILL

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 305.2.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	8.500	9.000	10.000	10.500	11.000	12.000	12.500	13.000	13.500	14.000	15.000	15.500	16.500	17.500	18.000	19.000	20.000
T	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500	3.000	3.000	3.500	3.500	4.000	4.000	4.500	4.500	5.000
A	1.500	1.500	2.000	2.000	1.500	2.000	2.000	2.000	2.000	2.000	2.500	2.500	3.000	3.500	4.000	4.500	5.000
B	2.500	2.583	2.667	2.750	2.833	2.917	2.958	3.042	3.083	3.167	3.208	3.292	3.333	3.417	3.458	3.542	3.583
C	4.500	4.917	5.333	5.750	6.667	7.083	7.542	7.958	8.417	8.833	9.292	9.708	10.167	10.583	10.542	10.958	11.417
L	3.600	3.900	5.600	6.000	8.000	8.500	8.750	9.250	9.500	12.000	12.300	12.900	13.200	13.800	14.100	14.700	15.000
M	1.917	2.500	3.167	4.083	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
N	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.250	1.500	1.500	1.500	1.917	1.917	1.917	1.917	1.917
P	1.000	1.000	1.250	1.250	1.000	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.500	1.917	1.917	2.500	2.500
HOOK	1.000	1.167	1.167	1.333	1.333	1.583	1.583	1.833	1.833	1.833	2.000	2.000	1.583	1.583	1.583	1.583	1.833
A bars	6 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	9 @ 6	9 @ 6	9 @ 6	9 @ 6	10 @ 6
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	7 @ 18	8 @ 18	9 @ 18	10 @ 18	11 @ 17	11 @ 14	11 @ 15.5	11 @ 13	11 @ 13.5	11 @ 12	11 @ 12	11 @ 10.5	11 @ 10.5	11 @ 9.5	11 @ 10.5	11 @ 9.5	11 @ 9.5
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @18	6 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 18
E bars	4 @ 18	4 @ 18	5 @ 18	5 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18

Quantities of Materials

Stem Concrete (yd^3/ft)	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.6	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Footing Concrete (yd^3/ft)	0.6	0.7	0.7	0.8	0.8	0.9	1.2	1.2	1.5	1.6	2.0	2.0	2.5	2.6	3.0	3.2	3.7
Steel (lb/ft)	98	117	152	171	200	233	243	280	292	399	454	470	488	510	524	550	631

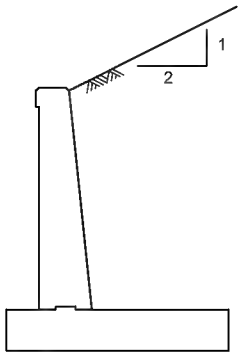
Maximum Soil Bearing Pressure

Q_{max} (psf)	5123	5663	5432	5954	7019	6759	7346	7886	8482	9033	8817	9355	9178	8984	9103	8948	8892

Notes:

1. *All dimensions are in feet, unless specified otherwise.*
2. *Spacings of reinforcing bars are in inches.*
3. *Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.*

ASSUMED DESIGN PARAMETERS
DENSE FOUNDATION SOIL, SLOPING BACKFILL



1. BACKFILL LOADING CONDITIONS:

   2H:1V SLOPING BACKFILL

2. BACKFILL SOIL PROPERTIES:

   TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

   Ø = ANGLE OF INTERNAL FRICTION = 37°

   δ = ANGLE OF WALL FRICTION = 22°

   γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

   q_f = FACTORED BEARING CAPACITY = 9400 psf

   FRICTION FACTOR = 0.57

   $Ø_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

   A = 0.17g (Max.)

   Kh = 0.085

   Kv = 0

5. REINFORCED CONCRETE:

   F'_c = 4000 psi

   F_y = 60000 psi

   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

massDOT Highway Division — Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CANTILEVER RETAINING WALLS
DENSE FOUNDATION SOILS, LEVEL BACKFILL, SURCHARGE

DRAWING NUMBER **E 305.3.0**

DATE OF ISSUE OCTOBER 2017

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	7.000	7.500	8.000	8.500	9.000	9.000	9.500	10.000	10.500	11.000	11.000	11.500	12.000	12.500	13.000	13.000	13.500
T	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500
A	2.500	2.500	2.500	2.500	3.000	3.000	3.000	3.000	3.500	3.500	3.500	4.000	4.000	4.000	4.500	4.500	4.500
B	2.500	2.583	2.667	2.750	2.833	2.917	3.000	3.083	3.167	3.250	3.333	3.417	3.500	3.583	3.667	3.708	3.792
C	2.000	2.417	2.833	3.250	3.167	3.083	3.500	3.917	3.833	4.250	4.167	4.083	4.500	4.917	4.833	4.792	5.208
L	2.400	2.600	4.200	4.500	6.400	6.800	7.200	9.500	10.000	10.500	11.000	13.800	14.400	15.000	15.600	15.900	16.500
M	1.000	1.000	1.000	1.250	1.250	1.250	1.500	1.917	1.917	2.500	2.500	2.500	3.167	4.083	4.083	3.167	4.083
N	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.250	1.250
P	1.250	1.250	1.250	1.250	1.500	1.500	1.917	1.917	2.500	2.500	2.500	3.167	4.083	4.083	5.000	4.083	4.083
HOOK	0.833	1.000	1.000	1.000	1.000	1.167	1.333	1.333	1.333	1.583	1.583	1.833	1.833	1.833	1.833	2.000	2.000
A bars	5 @ 12	6 @ 12	6 @ 12	6 @ 12	6 @ 12	7 @ 12	8 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	4 @ 18	4 @ 18	4 @ 16	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	9 @ 18	10 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18
E bars	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	11 @ 18	10 @ 18	10 @ 18

Quantities of Materials

Stem Concrete (yd^3/ft)	0.9	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.7
Footing Concrete (yd^3/ft)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.3
Steel (lb/ft)	76	86	96	104	118	133	161	182	198	233	240	307	340	360	388	412	438

Maximum Soil Bearing Pressure

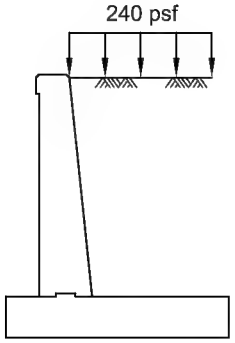
Q_{max} (psf)	4071	4328	4591	4860	4811	5491	5752	6018	5945	6208	6917	6833	7090	7352	7271	8079	8332

Notes:

1. *All dimensions are in feet, unless specified otherwise.*
2. *Spacings of reinforcing bars are in inches.*
3. *Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.*

ASSUMED DESIGN PARAMETERS

DENSE FOUNDATION SOIL, LEVEL BACKFILL, SURCHARGE



1. BACKFILL LOADING CONDITIONS:

   LEVEL BACKFILL;
   240 psf LIVE LOAD SURCHARGE.

2. BACKFILL SOIL PROPERTIES:

   TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

   Ø = ANGLE OF INTERNAL FRICTION = 37°

   δ = ANGLE OF WALL FRICTION = 22°

   γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

   q_f = FACTORED BEARING CAPACITY = 9400 psf

   FRICTION FACTOR = 0.57

   $Ø_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

   A = 0.17g (Max.)

   Kh = 0.085

   Kv = 0

5. REINFORCED CONCRETE:

   F'_c = 4000 psi

   F_y = 60000 psi

   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

massDOT Highway Division
Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CANTILEVER RETAINING WALLS
LOOSE FOUNDATION SOILS,
SLOPING BACKFILL

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 305.4.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	10.000	11.000	11.500	13.000	14.000	15.000	15.500	16.500	17.500	18.500	20.000	20.500	22.000	23.000	24.000	25.000	26.000
T	2.000	2.000	2.000	2.500	2.500	3.000	3.000	3.500	3.500	4.000	4.000	4.500	4.500	5.000	5.500	5.500	6.000
A	1.000	1.000	1.000	2.000	2.500	2.500	2.500	3.000	3.500	4.000	5.000	5.000	6.000	6.500	7.000	7.500	8.000
B	2.500	2.583	2.667	2.708	2.792	2.833	2.917	2.958	3.042	3.083	3.167	3.208	3.292	3.333	3.375	3.458	3.500
C	6.500	7.417	7.833	8.292	8.708	9.667	10.083	10.542	10.958	11.417	11.833	12.292	12.708	13.167	13.625	14.042	14.500
L	3.600	3.900	5.600	5.800	6.200	6.400	8.500	8.750	9.250	9.500	10.000	10.250	10.750	13.200	13.500	14.100	14.400
M	4.083	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
N	1.000	1.250	1.250	1.250	1.500	1.500	1.500	1.917	1.917	1.917	1.917	1.917	2.500	2.500	3.167	3.167	3.167
P	1.000	1.000	1.000	1.000	1.250	1.000	1.250	1.250	1.500	1.500	1.917	1.917	2.500	2.500	2.500	3.167	3.167
HOOK	1.000	1.167	1.167	1.167	1.333	1.333	1.583	1.583	1.833	1.833	2.000	2.000	2.000	1.583	1.583	1.583	1.583
A bars	6 @ 12	7 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	11 @ 12	9 @ 6	9 @ 6	9 @ 6	9 @ 6
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	10 @ 18	11 @ 15.5	11 @ 13	11 @ 14.5	11 @ 12.5	11 @ 11.5	11 @ 10	11 @ 10.5	11 @ 9	11 @ 9	11 @ 8	11 @ 8.5	11 @ 7.5	11 @ 7.5	11 @ 7.5	11 @ 6.5	11 @ 6.5
D bars	4 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	6 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 16	7 @ 16	8 @ 18	8 @ 18	9 @ 18	9 @ 18	9 @ 18
E bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	4 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	7 @ 16	7 @ 16	8 @ 18	8 @ 18	8 @ 18	9 @ 18	9 @18

Quantities of Materials

Stem Concrete (yd^3/ft)	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.6	1.6	1.7	1.8	1.9	2.0	2.2	2.2	2.2
Footing Concrete (yd^3/ft)	0.7	0.8	0.9	1.2	1.3	1.7	1.7	2.1	2.3	2.7	3.0	3.4	3.7	4.3	4.9	5.1	5.8
Steel (lb/ft)	126	158	173	189	219	309	351	379	422	440	500	516	557	588	625	653	664

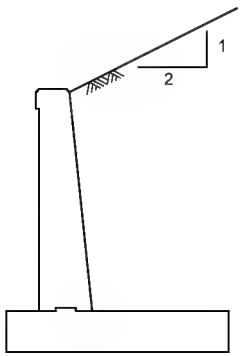
Maximum Soil Bearing Pressure

Q_{max} (psf)	4918	5231	5737	5064	4998	5371	5816	5814	5771	5807	5387	5847	5473	5567	5667	5687	5797

Notes:

1. *All dimensions are in feet, unless specified otherwise.*
2. *Spacings of reinforcing bars are in inches.*
3. *Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.*

ASSUMED DESIGN PARAMETERS
LOOSE FOUNDATION SOIL, SLOPING BACKFILL



1. BACKFILL LOADING CONDITIONS:

   2H:1V SLOPING BACKFILL

2. BACKFILL SOIL PROPERTIES:

   TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

   Ø = ANGLE OF INTERNAL FRICTION = 37°

   δ = ANGLE OF WALL FRICTION = 22°

   γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

   q_f = FACTORED BEARING CAPACITY = 6000 psf

   FRICTION FACTOR = 0.50

   $Ø_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

   A = 0.17g (Max.)

   Kh = 0.085

   Kv = 0

5. REINFORCED CONCRETE:

   F'_c = 4000 psi

   F_y = 60000 psi

   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

massDOT Highway Division — Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CANTILEVER RETAINING WALLS
LOOSE FOUNDATION SOILS,
LEVEL BACKFILL, SURCHARGE

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 305.5.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	7.500	8.000	8.000	8.500	9.000	9.500	10.000	10.500	11.000	11.500	12.000	13.000	13.500	14.000	15.000	15.500	16.000
T	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500	2.500	2.500
A	1.500	1.500	1.750	2.000	2.500	2.500	2.500	3.000	3.000	3.500	3.750	4.250	4.500	5.000	5.500	5.500	6.000
B	2.500	2.583	2.667	2.750	2.833	2.917	3.000	3.083	3.167	3.250	3.333	3.417	3.500	3.542	3.625	3.750	3.875
C	3.500	3.917	3.583	3.750	3.667	4.083	4.500	4.417	4.833	4.750	4.917	5.333	5.500	5.458	5.875	6.250	6.125
L	2.400	2.600	4.200	4.500	6.400	6.800	7.200	9.500	10.000	10.500	11.000	11.500	14.400	14.700	15.300	15.900	16.500
M	1.250	1.500	1.500	1.500	1.500	1.917	2.500	2.500	3.167	3.167	3.167	4.083	4.083	3.167	4.083	5.000	5.000
N	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.500	1.250	1.500	1.500	1.500
P	1.000	1.000	1.000	1.000	1.250	1.250	1.500	1.917	1.917	2.500	2.500	3.167	4.083	3.167	4.083	4.083	5.000
HOOK	0.833	0.833	1.000	1.000	1.167	1.167	1.167	1.333	1.333	1.583	1.583	1.583	1.833	1.833	2.000	2.000	2.000
A bars	5 @ 12	5 @ 12	6 @ 12	6 @ 12	7 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	11 @ 12
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	5 @ 18	6 @ 18	6 @ 18	6 @ 18	6 @ 18	7 @ 18	8 @ 18	8 @ 18	9 @ 18	9 @ 18	9 @ 18	10 @ 18	10 @ 16	9 @ 16	10 @ 18	11 @ 18	11 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	5 @ 18	6 @ 18	6 @ 18	6 @ 18
E bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	9 @ 18	10 @ 18	10 @ 18	11 @ 18

Quantities of Materials

Stem Concrete (yd^3/ft)	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.1	2.3	2.4	2.6	2.7
Footing Concrete (yd^3/ft)	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.3	1.4	1.4	1.5
Steel (lb/ft)	79	86	101	106	130	141	157	191	211	246	257	287	365	343	435	463	492

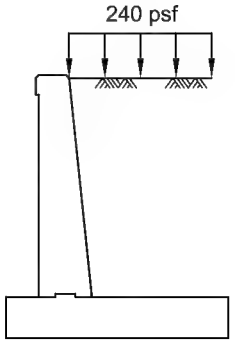
Maximum Soil Bearing Pressure

Q_{max} (psf)	4318	4614	5111	5210	5133	5412	5693	5616	5893	5824	5929	5558	5670	5733	5440	5695	5687

Notes:

1. *All dimensions are in feet, unless specified otherwise.*
2. *Spacings of reinforcing bars are in inches.*
3. *Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.*

ASSUMED DESIGN PARAMETERS
LOOSE FOUNDATION SOIL, LEVEL BACKFILL, SURCHARGE



1. BACKFILL LOADING CONDITIONS:

   LEVEL BACKFILL;
   240 psf LIVE LOAD SURCHARGE.

2. BACKFILL SOIL PROPERTIES:

   TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

   Ø = ANGLE OF INTERNAL FRICTION = 37°

   δ = ANGLE OF WALL FRICTION = 22°

   γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

   q_f = FACTORED BEARING CAPACITY = 6000 psf

   FRICTION FACTOR = 0.5

   $Ø_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

   A = 0.17g (Max.)

   Kh = 0.085

   Kv = 0

5. REINFORCED CONCRETE:

   F'_c = 4000 psi

   F_y = 60000 psi

   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

massDOT Highway Division — Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CANTILEVER RETAINING WALLS
ROCK FOUNDATION, SLOPING BACKFILL

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 305.6.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	8.500	9.000	9.000	9.500	10.000	10.500	11.000	11.500	12.000	13.000	13.500	14.000	14.500	15.000	15.500	16.000	16.500
T	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500	2.500	2.500	2.500	2.500	3.000	3.000	3.500
A	1.500	2.000	2.500	3.000	3.000	3.500	3.500	4.000	4.500	4.500	4.500	5.000	5.000	5.500	5.500	6.000	6.000
B	2.500	2.583	2.667	2.750	2.833	2.917	3.000	3.083	3.125	3.208	3.292	3.375	3.458	3.542	3.583	3.667	3.708
C	4.500	4.417	3.833	3.750	4.167	4.083	4.500	4.417	4.375	5.292	5.708	5.625	6.042	5.958	6.417	6.333	6.792
L	3.600	3.900	5.600	6.000	8.000	8.500	9.000	11.400	11.700	12.300	12.900	13.500	16.450	17.150	17.500	18.200	18.550
M	1.917	1.917	1.917	1.917	1.917	1.917	2.500	2.500	1.917	3.167	4.083	4.083	5.000	5.000	5.000	5.000	5.000
N	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.250	1.000	1.250	1.250	1.250	1.250	1.250	1.500	1.250	1.500
P	1.000	1.000	1.250	1.917	1.917	2.500	2.500	3.167	3.167	3.167	4.083	4.083	5.000	5.000	5.000	5.000	5.000
HOOK	1.000	1.167	1.167	1.333	1.333	1.583	1.583	1.833	1.833	2.000	2.000	1.583	1.583	1.833	1.833	1.833	1.833
A bars	6 @ 12	7 @ 12	7 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12	9 @ 6	9 @ 6	10 @ 6	10 @ 6	10 @ 6	10 @ 6
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	7 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 18	7 @ 17	8 @ 18	8 @ 18	7 @ 17	9 @ 18	10 @ 18	10 @ 18	11 @ 18	11 @ 18	11 @ 18	11 @ 18	11 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 17	5 @ 18	5 @ 16	6 @ 18	5 @ 15	6 @ 17
E bars	4 @ 18	4 @ 18	5 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	9 @ 18	9 @ 18	9 @ 18	10 @ 18	10 @ 17	11 @ 18	11 @ 16	11 @ 18	11 @ 15	11 @ 17

Quantities of Materials

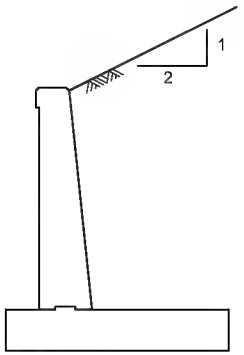
Stem Concrete (yd^3/ft)	0.9	0.9	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.5	2.7
Footing Concrete (yd^3/ft)	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.9	1.1	1.2	1.3	1.3	1.3	1.4	1.7	1.8	2.1
Steel (lb/ft)	98	120	125	148	164	197	213	272	276	342	379	382	446	503	543	558	580

Maximum Soil Bearing Pressure

Q_{max} (psf)	5123	5161	5481	5530	6053	6103	6626	6677	6838	7053	7562	7625	8134	8197	8802	8870	9475

Notes:

1. *All dimensions are in feet, unless specified otherwise.*
2. *Spacings of reinforcing bars are in inches.*
3. *Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.*



ASSUMED DESIGN PARAMETERS
ROCK FOUNDATION, SLOPING BACKFILL

1. BACKFILL LOADING CONDITIONS:

   2H:1V SLOPING BACKFILL

2. BACKFILL SOIL PROPERTIES:

   TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

   Ø = ANGLE OF INTERNAL FRICTION = 37°

   δ = ANGLE OF WALL FRICTION = 22°

   γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

   q_f = FACTORED BEARING CAPACITY = 20000 psf

   FRICTION FACTOR = 0.70

   $Ø_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

   A = 0.17g (Max.)

   Kh = 0.085

   Kv = 0

5. REINFORCED CONCRETE:

   F'_c = 4000 psi

   F_y = 60000 psi

   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

massDOT Highway Division — Massachusetts Department of Transportation

CONSTRUCTION STANDARDS

CANTILEVER RETAINING WALLS
ROCK FOUNDATION, LEVEL BACKFILL, SURCHARGE

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 305.7.0

TABLE OF DIMENSIONS AND REINFORCING STEEL

H	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0
W	7.000	7.500	8.000	8.500	9.000	9.000	9.500	10.000	10.500	11.000	11.000	11.500	12.000	12.500	13.000	13.000	13.500
T	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.500	2.500
A	2.500	2.500	2.500	2.500	3.000	3.000	3.000	3.000	3.500	3.500	3.500	4.000	4.000	4.000	4.500	4.500	4.500
B	2.500	2.583	2.667	2.750	2.833	2.917	3.000	3.083	3.167	3.250	3.333	3.417	3.500	3.583	3.667	3.708	3.792
C	2.000	2.417	2.833	3.250	3.167	3.083	3.500	3.917	3.833	4.250	4.167	4.083	4.500	4.917	4.833	4.792	5.208
L	2.400	2.600	4.200	4.500	6.400	6.800	7.200	9.500	10.000	10.500	11.000	13.800	14.400	15.000	15.600	15.900	16.500
M	1.000	1.000	1.000	1.250	1.250	1.250	1.500	1.917	1.917	2.500	2.500	2.500	3.167	4.083	4.083	3.167	4.083
N	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.250	1.250	1.250	1.250	1.250	1.250
P	1.250	1.250	1.250	1.250	1.500	1.500	1.917	1.917	2.500	2.500	2.500	3.167	4.083	4.083	5.000	4.083	4.083
HOOK	0.833	1.000	1.000	1.000	1.000	1.167	1.333	1.333	1.333	1.583	1.583	1.833	1.833	1.833	1.833	2.000	2.000
A bars	5 @ 12	6 @ 12	6 @ 12	6 @ 12	6 @ 12	7 @ 12	8 @ 12	8 @ 12	8 @ 12	9 @ 12	9 @ 12	10 @ 12	10 @ 12	10 @ 12	10 @ 12	11 @ 12	11 @ 12
B bars	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12	4 @ 12
C bars	4 @ 18	4 @ 18	4 @ 16	5 @ 18	5 @ 18	5 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	9 @ 18	10 @ 18
D bars	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	4 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18	5 @ 18
E bars	5 @ 18	5 @ 18	5 @ 18	5 @ 18	6 @ 18	6 @ 18	7 @ 18	7 @ 18	8 @ 18	8 @ 18	8 @ 18	9 @ 18	10 @ 18	10 @ 18	11 @ 18	10 @ 18	10 @ 18

Quantities of Materials

Stem Concrete (yd^3/ft)	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.7
Footing Concrete (yd^3/ft)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.2	1.3
Steel (lb/ft)	76	85	96	104	118	133	176	182	198	233	240	307	340	360	388	412	438

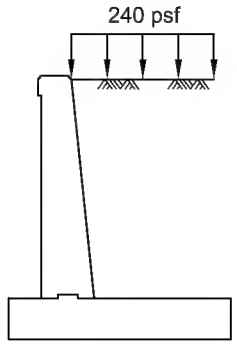
Maximum Soil Bearing Pressure

Q_{max} (psf)	4071	4328	4591	4860	4811	5491	5752	6018	5945	6208	6917	6833	7090	7352	7271	8079	8332

Notes:

1. *All dimensions are in feet, unless specified otherwise.*
2. *Spacings of reinforcing bars are in inches.*
3. *Designer must confirm design parameters with Geotechnical Engineer prior to selecting wall for site.*

ASSUMED DESIGN PARAMETERS
ROCK FOUNDATION, LEVEL BACKFILL, SURCHARGE



1. BACKFILL LOADING CONDITIONS:

   LEVEL BACKFILL;
   240 psf LIVE LOAD SURCHARGE.

2. BACKFILL SOIL PROPERTIES:

   TYPE: GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES

   Ø = ANGLE OF INTERNAL FRICTION = 37°

   δ = ANGLE OF WALL FRICTION = 22°

   γ = EFFECTIVE UNIT WEIGHT = 120 pcf

3. FOUNDATION SOIL PROPERTIES:

   q_f = FACTORED BEARING CAPACITY = 20000 psf

   FRICTION FACTOR = 0.70

   $Ø_{SLIDING}$ = PERFORMANCE FACTOR FOR SLIDING = 0.80

4. SEISMIC LOADING:

   A = 0.17g (Max.)

   Kh = 0.085

   Kv = 0

5. REINFORCED CONCRETE:

   F'_c = 4000 psi

   F_y = 60000 psi

   (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)

NOTES:

1. ALL DIMENSIONS OF STANDARD GUARDRAIL COMPONENTS, INCLUDING PANELS, POSTS, OFFSET BLOCKS, BOLTS, NUTS, WASHERS AND HOLES, ARE BASED UPON ENGLISH UNIT CONVERSIONS OF THE AASHTO-ARTBA-AGC JOINT COMMITTEE TASK FORCE 13 REPORT: *A GUIDE TO STANDARDIZING HIGHWAY BARRIER HARDWARE* (http://www.aashtotf13.org/Barrier-Hardware.php).

2. ALL GUARDRAIL MATERIALS SHALL CONFORM TO M8.07.0 UNLESS OTHERWISE INDICATED.

3. APPROVAL BY THE ENGINEER IS REQUIRED WHERE A DIFFERING GUARDRAIL CONFIGURATION IS REQUIRED FOR CONSTRUCTABILITY BEYOND THE OPTIONS SHOWN IN THESE STANDARDS OR THE PLANS.

4. THE BEGIN OR END STATION LABELS SHOWN IN THESE STANDARDS CORRESPOND TO THE STATION AND OFFSET CALLOUTS SPECIFIED IN THE PLANS.

5. USE 12'-6" NOMINAL LENGTH PANELS UNLESS OTHERWISE INDICATED IN THESE STANDARDS OR THE PLANS.

6. ALL LAP SPLICES SHALL BE MIDSPAN UNLESS OTHERWISE SHOWN.

7. LAP SPLICES SHALL BE CONSTRUCTED WITH THE SPLICE RIDGE ORIENTED DOWNSTREAM OF THE FINAL DIRECTION OF TRAFFIC IN THE NEAREST TRAVEL LANE. REORIENTING LAP SPLICES FOR TEMPORARY TRAFFIC CONTROL IS NOT REQUIRED.

8. STANDARD POSTS SHALL BE STEEL OR TIMBER, UNLESS OTHERWISE INDICATED IN THE PLANS, FABRICATED TO THE DIMENSIONS SHOWN ON 400.1.4. POSTS OF A SINGLE MATERIAL TYPE SHALL BE USED THROUGHOUT AN ENTIRE RUN OF GUARDRAIL; EXCEPTIONS ARE ALLOWED ONLY WHEN SPECIFIC MATERIAL TYPES ARE REQUIRED FOR TRANSITIONS, END TREATMENTS, AND/OR ANCHORAGES.

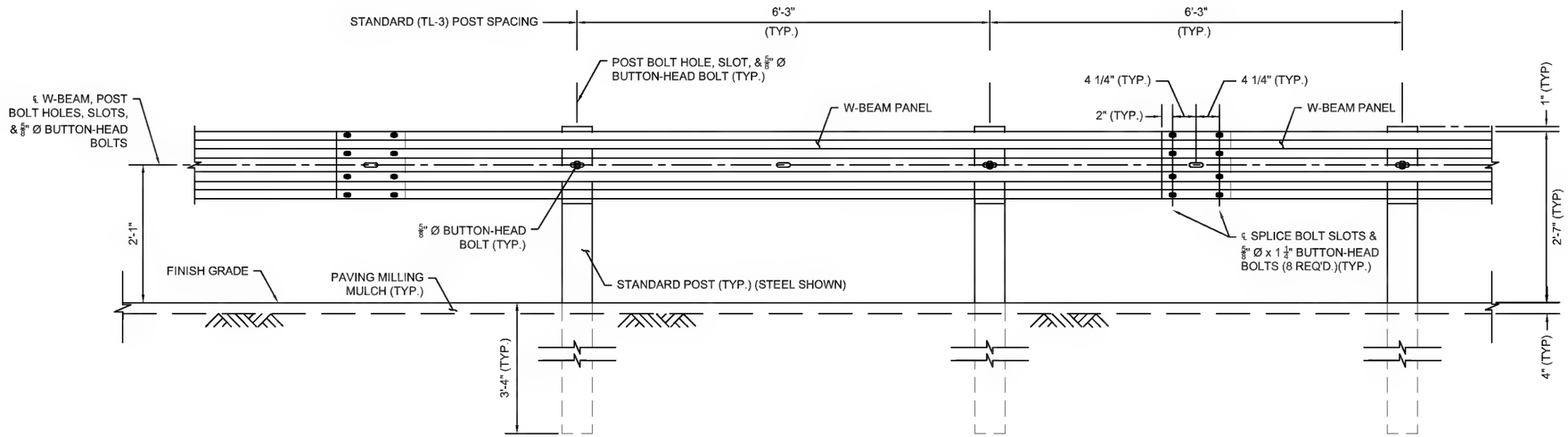
9. DEEP POST SHALL ONLY BE USED WHERE INDICATED IN THESE STANDARDS OR THE PLANS.

10. OFFSET BLOCKS, WHERE REQUIRED, SHALL BE TIMBER AND FABRICATED TO THE NOMINAL DIMENSIONS SHOWN ON 400.1.4. PLASTIC OR COMPOSITE OFFSET BLOCKS OF THE SAME NOMINAL DIMENSIONS THAT ARE LISTED ON THE QUALIFIED CONSTRUCTION MATERIALS LIST MAY BE SUBSTITUTED. OFFSET BLOCKS OF A SINGLE MATERIAL TYPE SHALL BE USED THROUGHOUT AN ENTIRE RUN OF GUARDRAIL; EXCEPTIONS ARE ALLOWED ONLY WHEN SPECIFIC MATERIAL TYPES ARE REQUIRED FOR TRANSITIONS, END TREATMENTS, AND/OR ANCHORAGES.

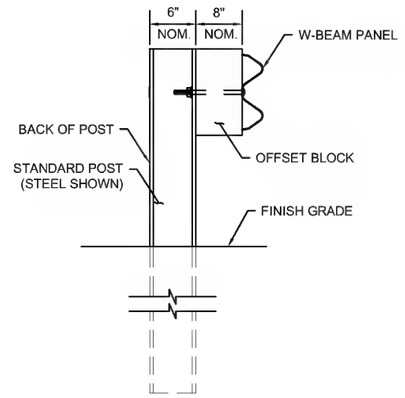
11. PAVEMENT MILLING MULCH, WHERE CALLED FOR IN THE STANDARDS, SHALL CONFORM TO SECTION 739.

12. GUARDRAIL DELINEATORS, CONFORMING TO SECTION 601, SHALL BE INSTALLED AT 25' INTERVALS WITHIN 100' OF AN END TREATMENT OR TRAILING ANCHORAGE AND AT 100' INTERVALS IN ALL OTHER AREAS UNLESS OTHERWISE SHOWN IN THE PLANS.

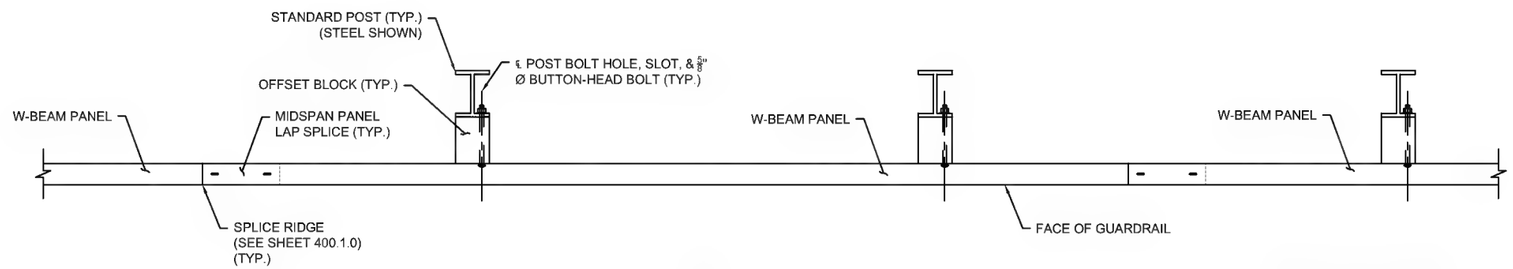
13. MINIMUM OFFSET DISTANCE FROM FACE OF W-BEAM PANEL TO A FIXED (NON-BREAKAWAY) OBJECT SHALL BE 48" FOR TL-2 AND 60" FOR TL-3.



ELEVATION



SECTION



PLAN

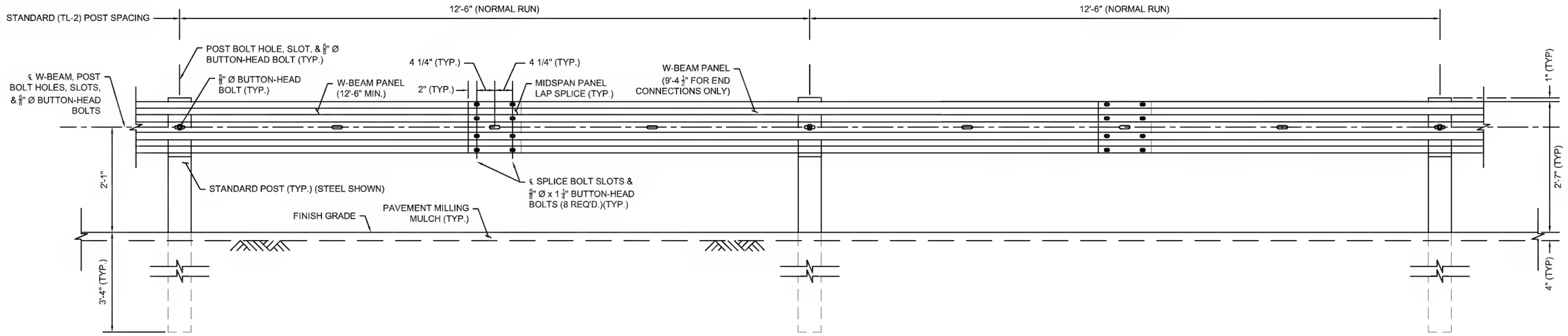
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

GUARDRAIL, TL-3

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
400.1.1



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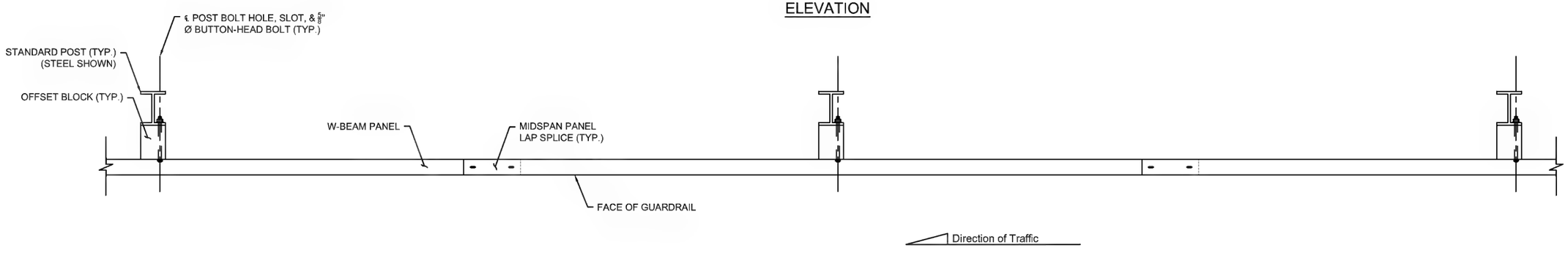


PLAN

NOTES:

1. A 9'-4 1/2" PANEL IS REQUIRED WHEN TRANSITIONING TO TL-3 W-BEAM GUARDRAIL TO MAINTAIN PROPER POST SPACING.

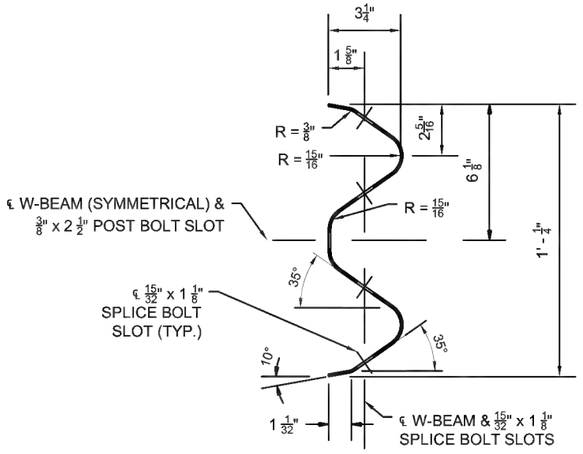
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

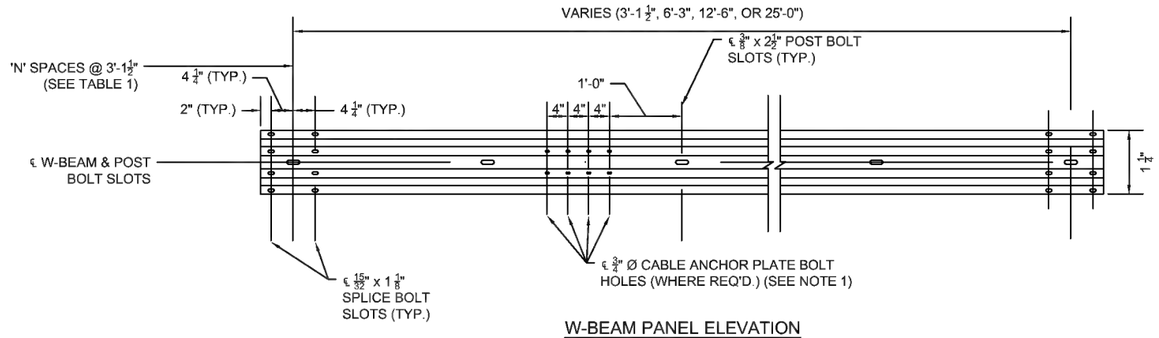
GUARDRAIL, TL-2

DATE OF ISSUE
OCTOBER 2017

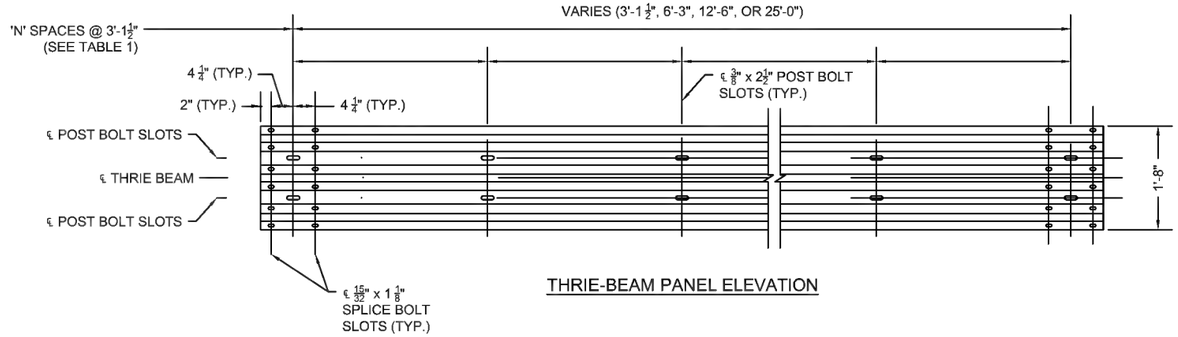
DRAWING NUMBER
400.1.2



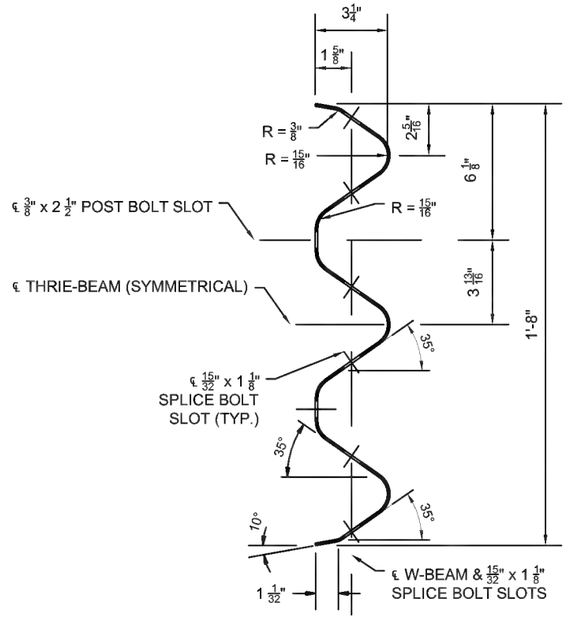
W-BEAM PANEL SECTION



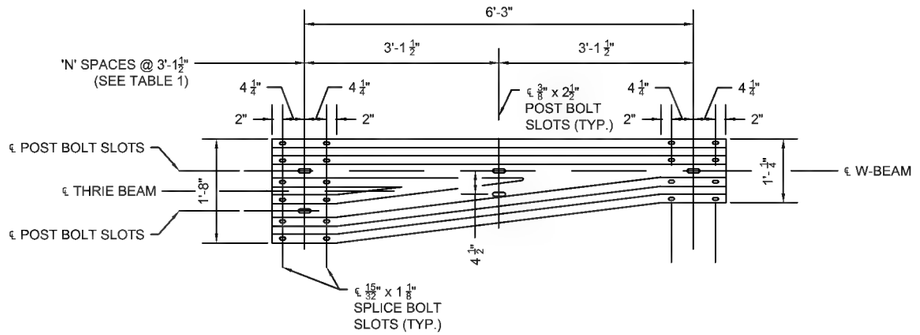
W-BEAM PANEL ELEVATION



THRIE-BEAM PANEL ELEVATION



THRIE-BEAM PANEL SECTION



THRIE-BEAM TRANSITION PANEL ELEVATION
(REVERSE DIRECTION SAME DIMENSIONS)

TABLE 1 : PANEL SUMMARY

PANEL TYPE	NUMBER OF SPACES 'N'	GAUGE
6'-3" W-BEAM	2	12
9'-4 1/2" W-BEAM	3	12
12'-6" W-BEAM	4	12
25'-0" W-BEAM	8	12
12'-6" THRIE-BEAM	4	12
25'-0" THRIE BEAM	8	12
THRIE-BEAM TRANS.	2	10

TABLE 2 : 5/8" BUTTON-HEAD BOLT LENGTHS

APPLICATION(S)	LENGTH 'L'	MIN. THREAD LENGTH
PANEL SPLICE	1 1/4"	FULL LENGTH
STEEL POST MOUNT - SINGLE FACED	10"	4"
TIMBER POST MOUNT - SINGLE FACED	18"	4"
STEEL POST MOUNT - DOUBLE FACED	10"	4"
TERMINAL CONNECTOR SPLICE	2"	FULL LENGTH

NOTES:

1. INCLUDE 3/4" Ø CABLE ANCHOR PLATE BOLT HOLES ONLY WHERE REQUIRED FOR THE INSTALLATION OF THE CABLE ANCHOR PLATE SHOWN ON 400.4.1 AND 400.4.2.
2. INSTALL BUTTON-HEAD BOLTS FOR POST MOUNTS AND SPLICES, AS REQUIRED. BOLT LENGTHS SHALL CONFORM TO TABLE 2 UNLESS OTHERWISE INDICATED. PLACE WASHERS UNDER NUTS; WASHERS ARE OPTIONAL AGAINST STEEL FLANGES. DO NOT PLACE WASHERS BETWEEN BOLT HEADS AND PANELS UNLESS OTHERWISE INDICATED.

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CONSTRUCTION STANDARDS
SECTION 400

W-BEAM & THRIE BEAM PANEL DETAILS

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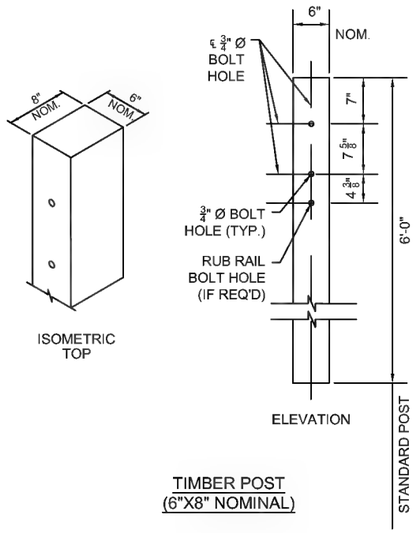
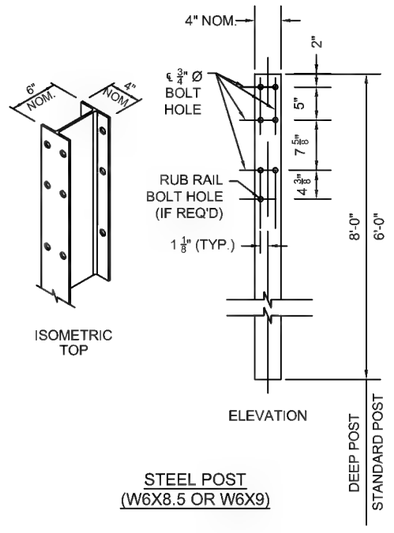
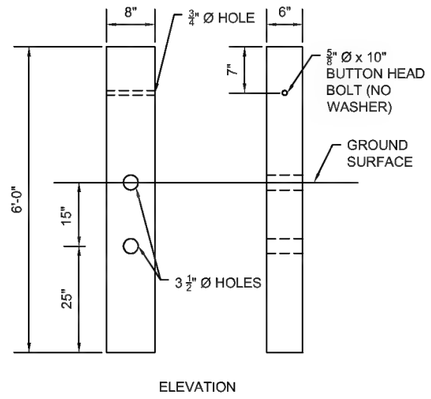


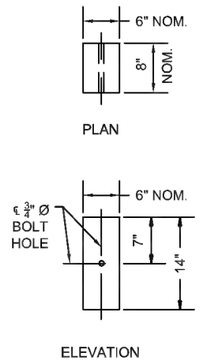
TIMBER POST
(6"X8" NOMINAL)



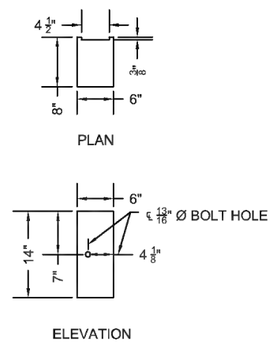
STEEL POST
(W6X8.5 OR W6X9)



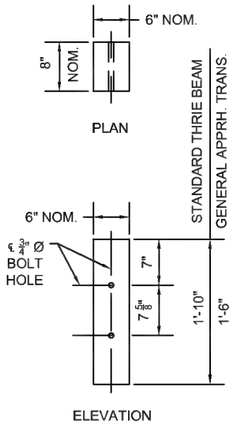
CRT POST (TIMBER ONLY)
(6" X 8" NOMINAL)
USE ONLY WHERE SPECIFIED



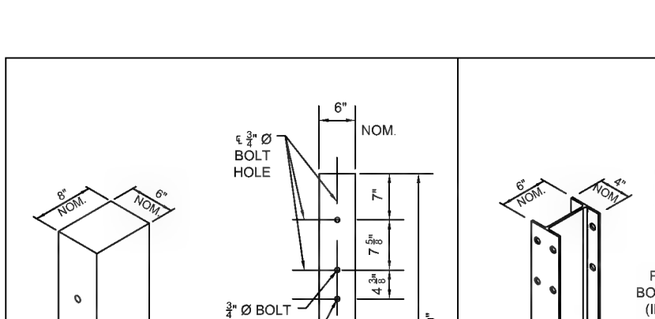
W-BEAM TIMBER OFFSET BLOCK
FOR USE WITH TIMBER POSTS
(6"X 8" NOMINAL)

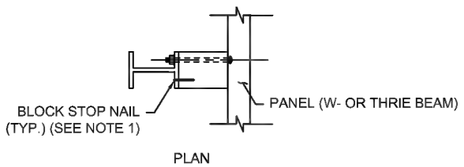


W-BEAM TIMBER OFFSET BLOCK
FOR USE WITH STEEL POSTS
(6"X8" NOMINAL)

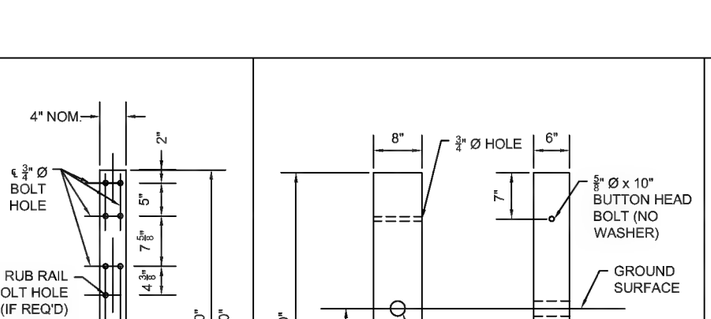


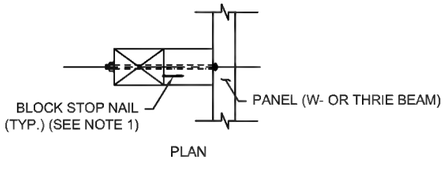
THRIE BEAM TIMBER OFFSET BLOCK
(6"X 8" NOMINAL)



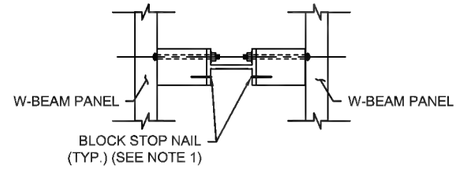


W-BEAM & THRIE BEAM
STEEL POST





W-BEAM & THRIE BEAM
TIMBER POST



DOUBLE FACED W-BEAM
STEEL POST ONLY

NOTES:

1. DRIVE ONE NAIL PER W BEAM TIMBER OFFSET BLOCK TO PREVENT BLOCK ROTATION. USE ASTM A153 HOT DIP GALVANIZED STEEL 3 ½" TYPE 16D NAILS. FOR STEEL POSTS, DRIVE THE NAIL THROUGH THE UNUSED FLANGE BOLT HOLE AND BEND THE NAIL SO ITS HEAD CONTACTS THE FLANGE.
2. DEEP STEEL POSTS SHALL ONLY BE USED WHERE INDICATED IN THESE STANDARDS OR THE PLANS.
3. WHERE BACK OF POSTS ARE EXPOSED AND PLACED WITHIN 2'-0" OF A SIDEWALK, SEPARATED BIKE FACILITY OR SHARED-USE PATH, TIMBER POSTS SHALL BE USED. ALTERNATIVELY, STEEL POSTS WITH A TIMBER BACKING, PER 400.5.1, MAY BE SUBSTITUTED AT NO ADDITIONAL COST. WHEN TIMBER POSTS ARE USED, ONE OF THE FOLLOWING SAFETY TREATMENTS IS REQUIRED FOR ALL BOLTS PROTRUDING FROM THE BACK FACE OF THE POST:
   - A. AFTER TIGHTENING THE NUT, TRIM THE PROTRUDING POST BOLT FLUSH WITH THE NUT AND GALVANIZE PER M7.04.11;
   - B. USE 15" POST BOLTS AND COUNTERSINK THE WASHER AND NUT BETWEEN 1" AND 1 ½" DEEP INTO THE BACK FACE OF THE POST; OR
   - C. USE 15" POST BOLT SLEEVE NUTS AND WASHERS.

END TREATMENTS AND TRANSITIONS, WHERE SPECIFIC MATERIAL TYPES ARE SPECIFIED, ARE EXEMPT FROM THESE REQUIREMENTS.

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Highway Division

CONSTRUCTION STANDARDS
SECTION 400

POST & OFFSET BLOCK DETAILS

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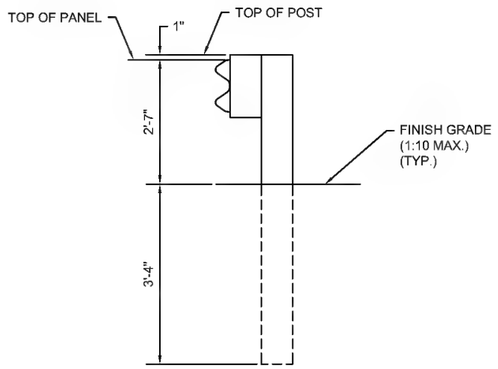
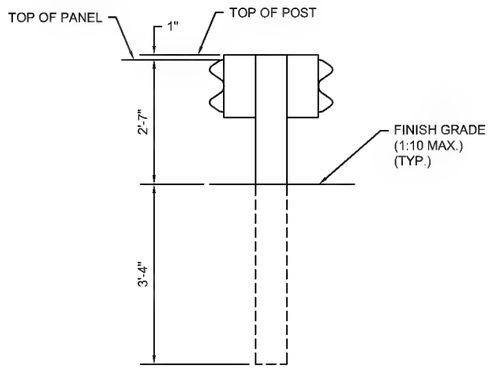
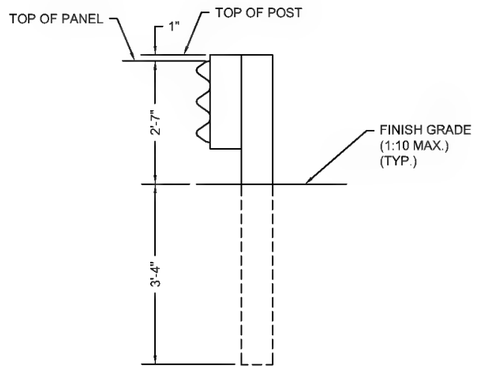


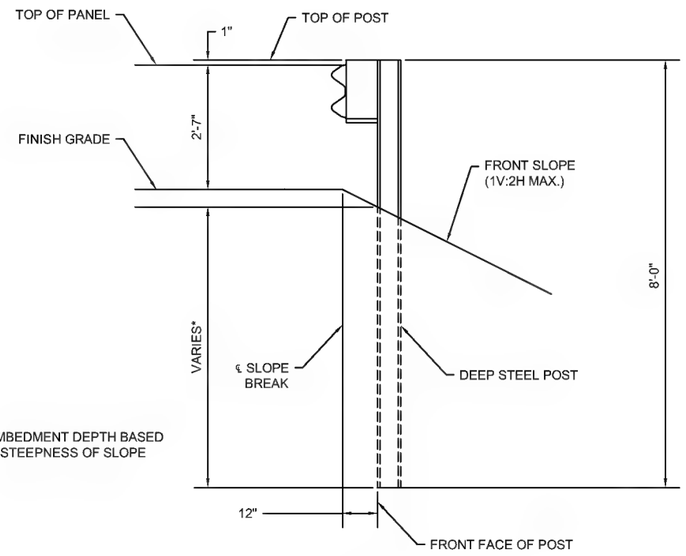
W-BEAM



DOUBLE FACED
W-BEAM



THRIE-BEAM



* EMBEDMENT DEPTH BASED
ON STEEPNESS OF SLOPE

SLOPE BREAK CONDITION
STEEL DEEP POST

NOTES:

1. CONSTRUCTION TOLERANCE FOR PANEL HEIGHT = ± 1".

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CONSTRUCTION STANDARDS
SECTION 400

GUARDRAIL MOUNTING HEIGHTS & POST DEPTHS

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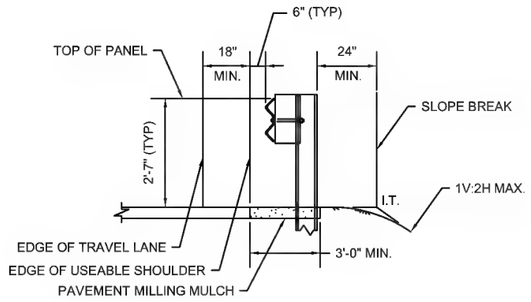
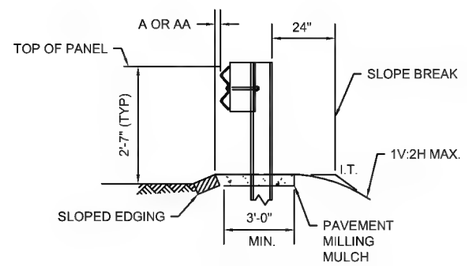
SINGLE FACED:

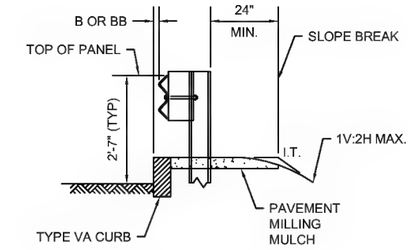


FLUSH WITH ROADWAY



SLOPED EDGING
(TYPE A BERM SIMILAR)

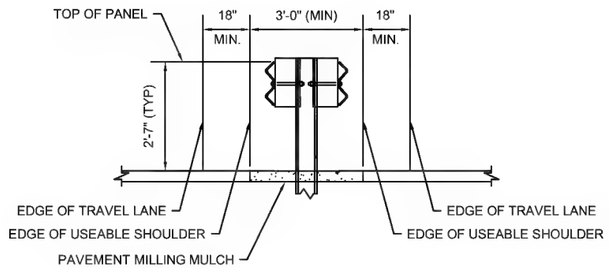
	TL-2	TL-3
A (AT FACE)	0" TO 6"	0" TO 6"
AA (OFFSET)	6'-0" (MIN)	N/A (SEE NOTE 5)



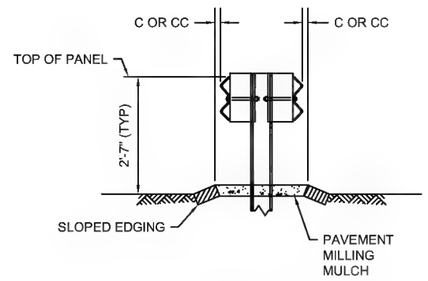
TYPE VA CURB
(HMA CURB SIMILAR)

	TL-2	TL-3
B (AT FACE)	0" TO 6"	0" TO 6"
BB (OFFSET)	6'-0" (MIN)	N/A (SEE NOTE 5)

DOUBLE FACED:

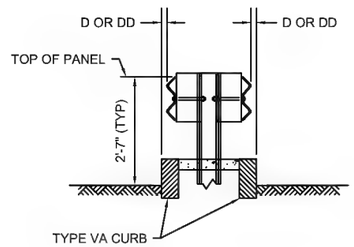


FLUSH WITH ROADWAY



SLOPED EDGING
(TYPE A BERM SIMILAR)

	TL-2	TL-3
C (AT FACE)	0" TO 10"	0" TO 10"
CC (OFFSET)	6'-0" (MIN)	13'-0" (MIN)

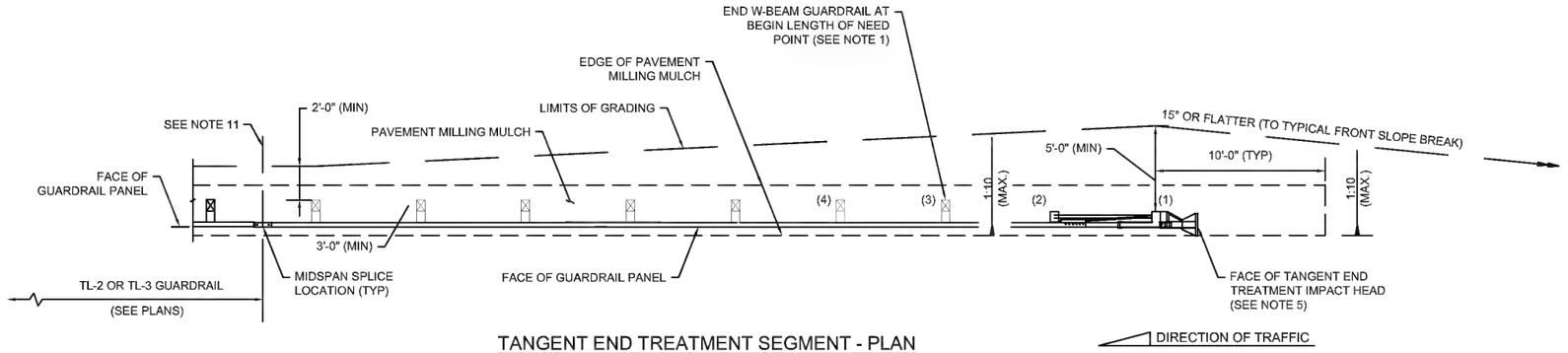


TYPE VA CURB
(HMA CURB SIMILAR)

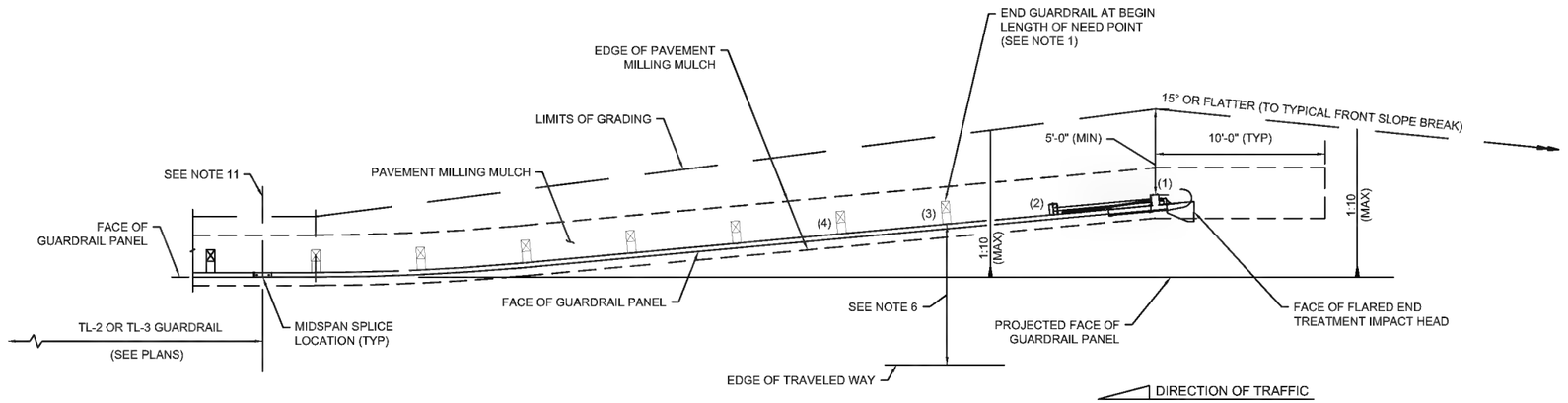
	TL-2	TL-3
D (AT FACE)	0" TO 10"	0" TO 10"
DD (OFFSET)	6'-0" (MIN)	N/A (SEE NOTE 5)

NOTES:

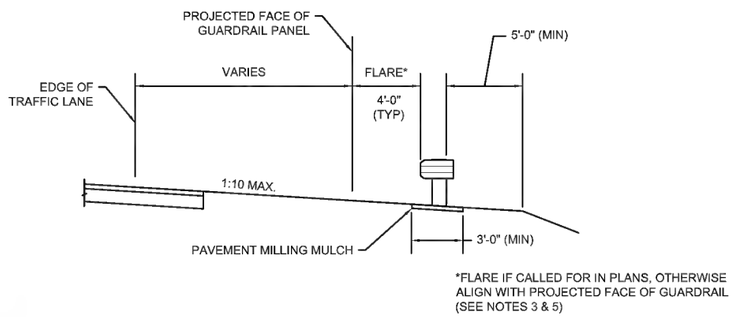
1. TYPE VA CURB PER E 106.3.0.
2. HMA CURB PER E 106.2.0.
3. SLOPED EDGING PER E 106.5.0.
4. TYPE A BERM PER E 106.1.0.
5. TL-3 GUARDRAIL SHALL NOT BE OFFSET FROM VERTICAL CURB AND SINGLE FACED TL-3 GUARDRAIL SHALL NOT BE OFFSET FROM SLOPED EDGING UNLESS OTHERWISE SHOWN IN THE PLANS OR THESE STANDARDS.
6. IN ORDER TO FACILITATE DESIGN AND CONSTRUCTION, THE OFFSET FROM THE CURB TO FACE OF GUARDRAIL DOES NOT HAVE TO BE SYMMETRICAL BETWEEN SIDES. ONE SIDE MAY BE LOCATED AT THE FACE OF CURB AND THE OPPOSITE MAY BE OFFSET.



TANGENT END TREATMENT SEGMENT - PLAN

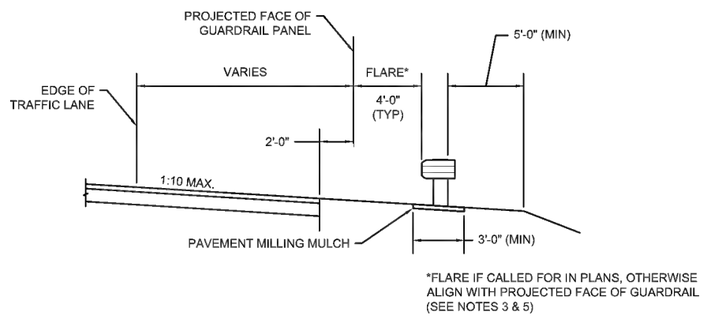


FLARED END TREATMENT SEGMENT - PLAN



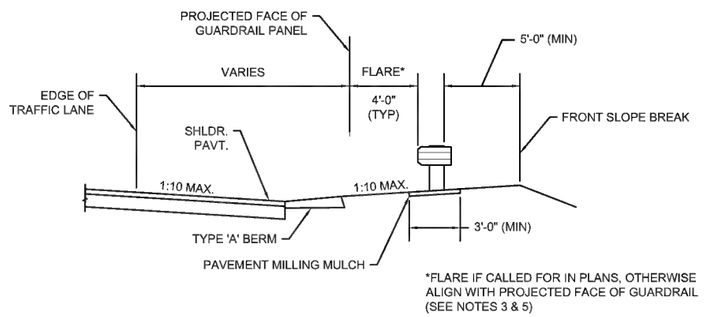
*FLARE IF CALLED FOR IN PLANS, OTHERWISE ALIGN WITH PROJECTED FACE OF GUARDRAIL (SEE NOTES 3 & 5)

SECTION AT POST (1)
WITH UNPAVED SHOULDER



*FLARE IF CALLED FOR IN PLANS, OTHERWISE ALIGN WITH PROJECTED FACE OF GUARDRAIL (SEE NOTES 3 & 5)

SECTION AT POST (1)
WITH FULLY PAVED SHOULDER



*FLARE IF CALLED FOR IN PLANS, OTHERWISE ALIGN WITH PROJECTED FACE OF GUARDRAIL (SEE NOTES 3 & 5)

SECTION AT POST (1)
WITH TYPE 'A' BERM

NOTES:

1. INSTALL GUARDRAIL AT STATION AND OFFSET SHOWN IN THE PLANS. THE END OF THE GUARDRAIL SHOWN IN THE PLANS CORRESPONDS WITH THE BEGIN LENGTH OF NEED POINT FOR THE END TREATMENT (SHOWN AT POST 3 IN THESE STANDARDS, BUT MAY VARY BY MANUFACTURER).
2. PROPRIETARY END TREATMENTS MAY VARY IN SIZE AND SHAPE FROM WHAT IS DEPICTED IN THESE STANDARDS. HOWEVER, THE MAXIMUM SLOPES AND MINIMUM OFFSETS DIMENSIONED FROM THE POSTS SHOWN HEREIN SHALL STILL APPLY.
3. END TREATMENT TEST LEVEL AND TYPE (TANGENT OR FLARED) SHALL BE SPECIFIED IN THE PLANS.
4. CONSTRUCT TANGENT AND FLARED END TREATMENTS IN ACCORDANCE WITH THE MANUFACTURER'S UNIQUE DRAWING DETAILS, PROCEDURES, AND SPECIFICATIONS.
5. AT THE DISCRETION OF THE ENGINEER, THE FACE OF THE TANGENT END TREATMENT IMPACT HEAD MAY BE OFFSET UP TO 2'-0" FROM THE PROJECTED FACE OF GUARDRAIL TO MINIMIZE NUISANCE HITS. THE OFFSET SHALL OCCUR OVER THE ENTIRE LENGTH OF THE END TREATMENT UNLESS OTHERWISE SPECIFIED BY THE MANUFACTURER.
6. LATERAL OFFSET OF FLARED END TREATMENT SHALL BE DETERMINED BY THE DESIGN ENGINEER FOLLOWING THE METHODOLOGY FOUND IN THE *ROADSIDE DESIGN GUIDE* AND SHOULD FALL WITHIN THE ALLOWABLE TOLERANCES SPECIFIED BY THE MANUFACTURER. LATERAL OFFSET SHALL BE MEASURED FROM THE EDGE OF TRAVELED WAY TO THE FACE OF THE GUARDRAIL AT POST #3.
7. END TREATMENTS SHALL NOT TERMINATE CURVED W-BEAM SEGMENTS.
8. END TREATMENT IMPACT HEAD DELINEATION SHALL CONFORM TO 601.63.
9. INSTALL GRADING AS SHOWN HEREIN UNDER SEPARATE PAY ITEMS.
10. SEE 400.2.2 FOR APPROACH TERMINAL GEOMETRY FOR GUARDRAIL INSTALLED ADJACENT TO CURB AND DOUBLE FACED GUARDRAIL.
11. MAINTAIN 2'-0" (MIN) OFFSET TO FRONT SLOPE BREAK DOWNSTREAM OF MIDSPAN SPLICE LOCATION AT ALL TIMES. IF, DOWNSTREAM OF THE SPLICE, GRADING CONSTRAINTS INHIBIT THIS MINIMUM OFFSET THEN USE DEEP STEEL POSTS AND TRANSITION TO A SLOPE BREAK CONDITION DESIGN PER THE DETAIL IN 400.1.5 UNTIL THE 2'-0" OFFSET CAN BE MET.

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CONSTRUCTION STANDARDS
SECTION 400

APPROACH GEOMETRY : SINGLE FACED

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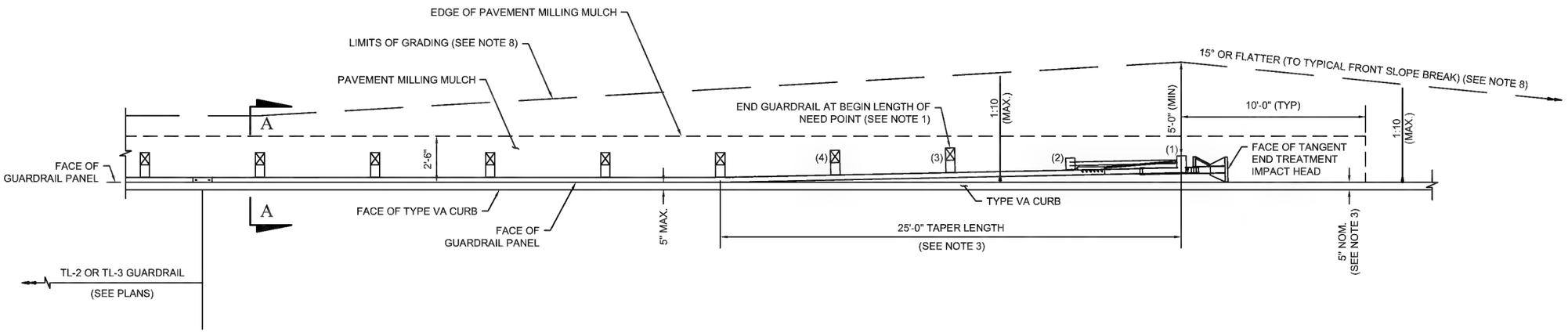
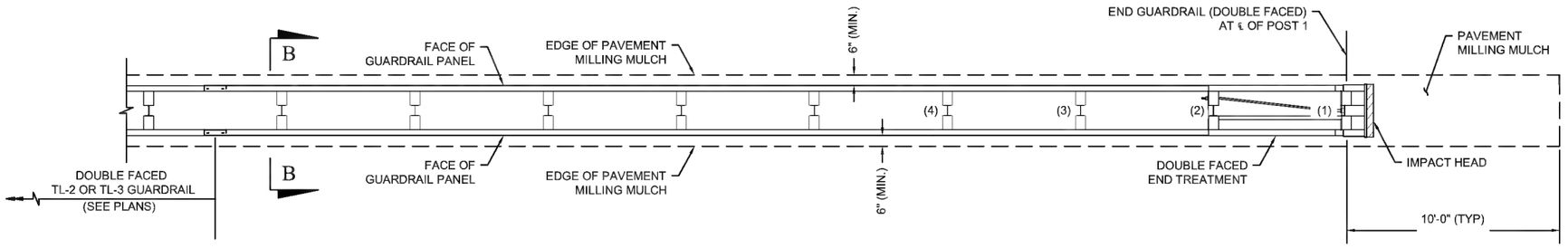
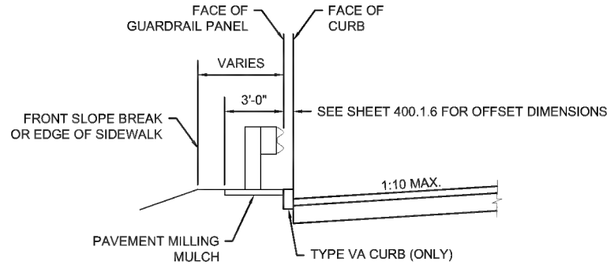


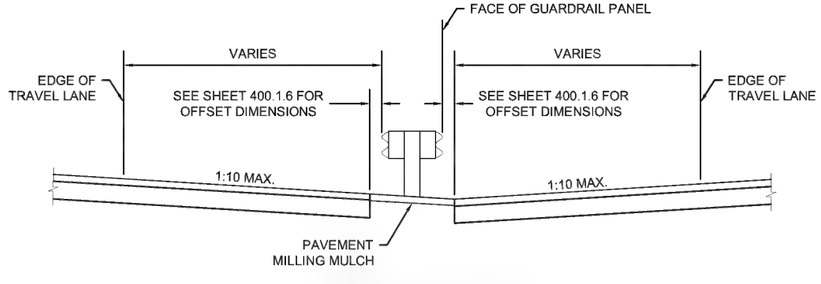
TANGENT END TREATMENT FOR GUARDRAIL
ADJACENT TO CURB - PLAN



END TREATMENT FOR GUARDRAIL
(DOUBLE FACED) - PLAN



'CURBED' SECTION A-A



'DOUBLE FACED' SECTION B-B
(1:10 SLOPE OR FLATTER REQD.)

NOTES:

1. INSTALL GUARDRAIL AT STATION(S) AND OFFSET(S) SHOWN IN THE PLANS. FOR TANGENT END TREATMENTS ADJACENT TO CURB, THE END OF THE GUARDRAIL SHOWN IN THE PLANS CORRESPONDS WITH THE BEGIN LENGTH OF NEED POINT FOR THE END TREATMENT (SHOWN AT POST 3 IN THESE STANDARDS, BUT MAY VARY BY MANUFACTURER). FOR DOUBLE FACED END TREATMENTS, THE END OF THE GUARDRAIL SHOWN IN THE PLANS CORRESPONDS WITH POST 1.
2. PROPRIETARY END TREATMENTS MAY VARY IN SIZE AND SHAPE FROM WHAT IS DEPICTED IN THESE STANDARDS. HOWEVER, THE MAXIMUM SLOPES AND MINIMUM OFFSETS DIMENSIONED FROM THE POSTS SHOWN HEREIN SHALL STILL APPLY.
3. END TREATMENT TEST LEVEL SHALL BE SPECIFIED IN THE PLANS.
4. CONSTRUCT TANGENT AND DOUBLE FACED END TREATMENTS IN ACCORDANCE WITH THE MANUFACTURER'S UNIQUE DRAWING DETAILS, PROCEDURES, AND SPECIFICATIONS.
5. THE FACE OF THE TANGENT END TREATMENT IMPACT HEAD SHALL BE OFFSET A MINIMUM OF 0'-5" AND UP TO 2'-0" FROM THE FACE OF CURB TO MINIMIZE NUISANCE HITS. THE OFFSET SHALL OCCUR OVER THE ENTIRE LENGTH OF THE END TREATMENT UNLESS OTHERWISE SPECIFIED BY THE MANUFACTURER.
6. END TREATMENTS SHALL NOT TERMINATE CURVED GUARDRAIL SEGMENTS.
7. END TREATMENT IMPACT HEAD DELINEATION SHALL CONFORM TO 601.63.
8. INSTALL GRADING AS SHOWN HEREIN UNDER SEPARATE PAY ITEMS. WHERE A TANGENT END TREATMENT FOR GUARDRAIL ADJACENT TO CURB IS INSTALLED IN FRONT OF A SIDEWALK, SEPARATED BIKE FACILITY, OR SHARED-USE PATH, THE GRADING OF THAT FACILITY SHALL SUPERSEDE THE GRADING SHOWN IN THESE STANDARDS.

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CONSTRUCTION STANDARDS
SECTION 400

APPROACH GEOMETRY : ADJACENT TO CURB & DOUBLE FACED

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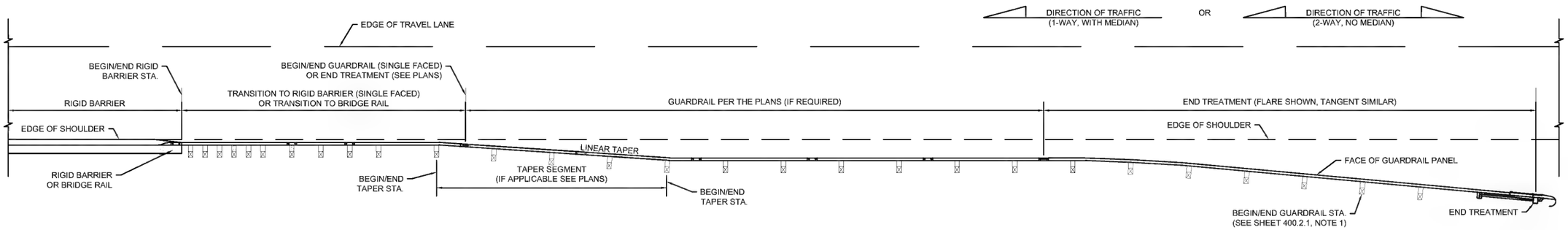
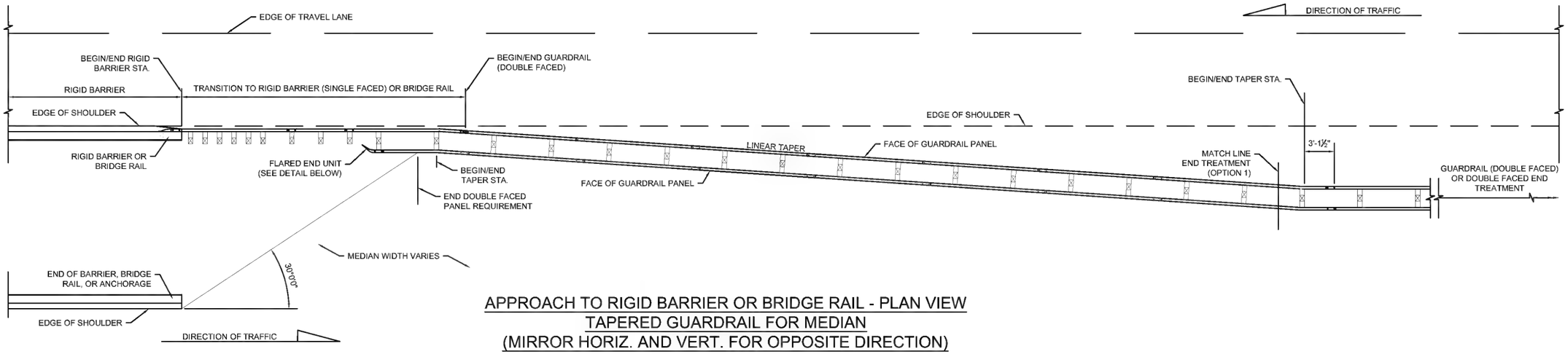
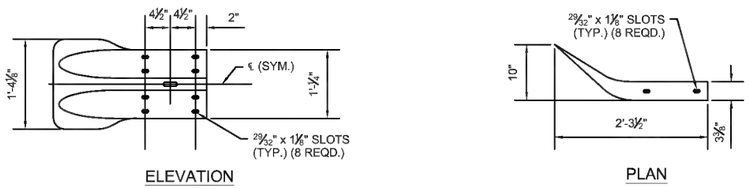


APPROACH TO RIGID BARRIER OR BRIDGE RAIL - PLAN VIEW
MEDIAN OR OUTSIDE SHOULDERS
(MIRROR HORIZ. AND/OR VERT. FOR OPPOSITE DIRECTION AND/OR SIDE OF ROAD)



APPROACH TO RIGID BARRIER OR BRIDGE RAIL - PLAN VIEW
TAPERED GUARDRAIL FOR MEDIAN
(MIRROR HORIZ. AND VERT. FOR OPPOSITE DIRECTION)



FLARED END UNIT

NOTES:

INSTALLATION: THE PLAN VIEWS SHOWN ARE SCHEMATIC ONLY, SHOWING EXAMPLE GEOMETRY FOR CONNECTING GUARDRAIL SEGMENTS INCLUDING TAPER LOCATIONS AND DOUBLE FACED GUARDRAIL REQUIREMENTS AS APPLICABLE. WORK THIS SHEET WITH THE PLANS, WHERE STATIONING AND OFFSETS FOR BEGIN/END GUARDRAIL, BEGIN/END RIGID BARRIER, AND BEGIN/END TAPER ARE SPECIFIED.

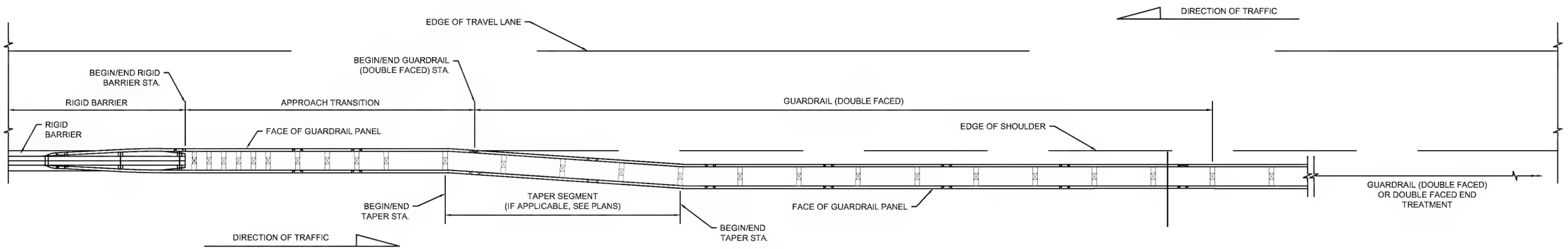
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

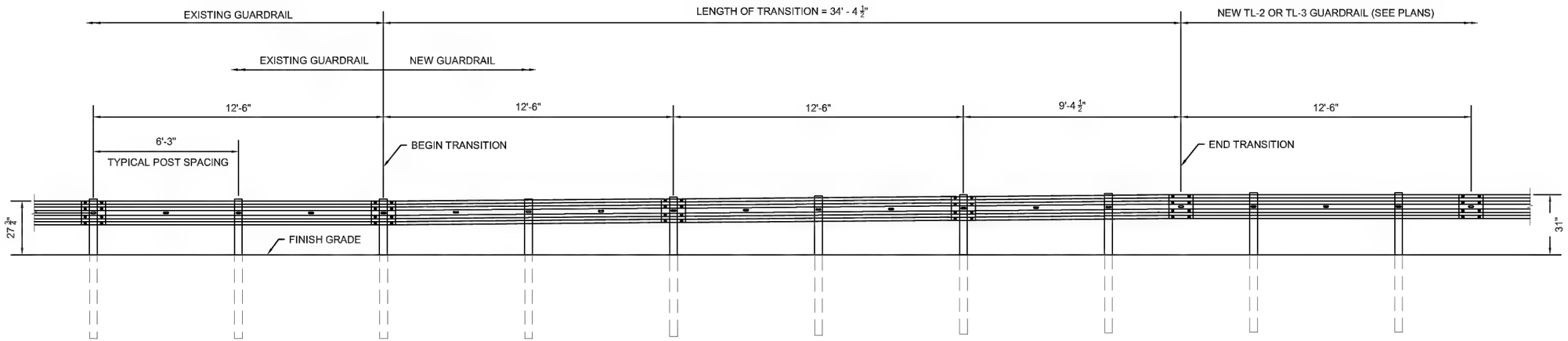
LAYOUT TO SINGLE FACED RIGID BARRIER OR BRIDGE RAIL

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
400.2.3



APPROACH TO RIGID BARRIER - DOUBLE FACED GUARDRAIL
PLAN VIEW - MEDIAN SHOULDERS ONLY
(MIRROR HORIZ. AND VERT. FOR OPPOSITE DIRECTION)



NOTES:

1. MAINTAIN STANDARD 1" CLEARANCE OF POST ABOVE PANEL THROUGHOUT THE ENTIRE LENGTH OF TRANSITION.
2. A MINIMUM OF ONE (1) 12'-6" PANEL SHALL BE PLACED BETWEEN THIS TRANSITION AND THE START OF ANY END TREATMENT OR ANCHORAGE.
3. ALL NEW POSTS SHALL BE 72" IN LENGTH UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.
4. ALL NEW POSTS AND OFFSET BLOCK MATERIALS SHALL MATCH EXISTING UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.

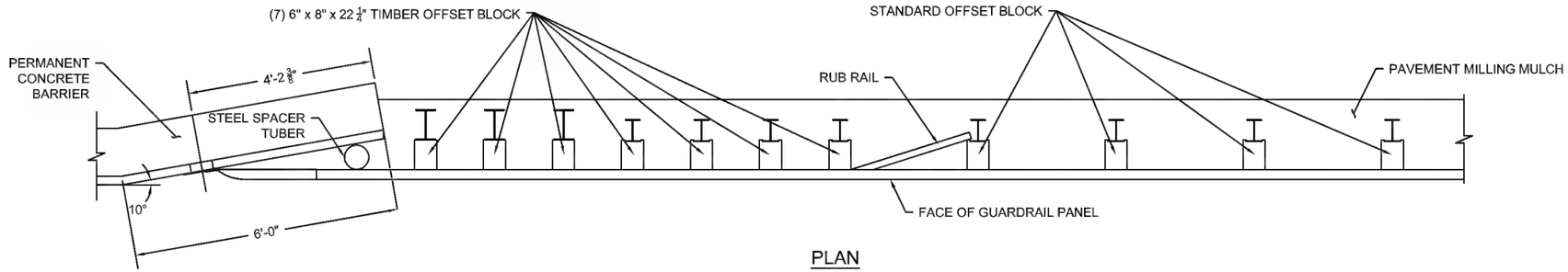
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

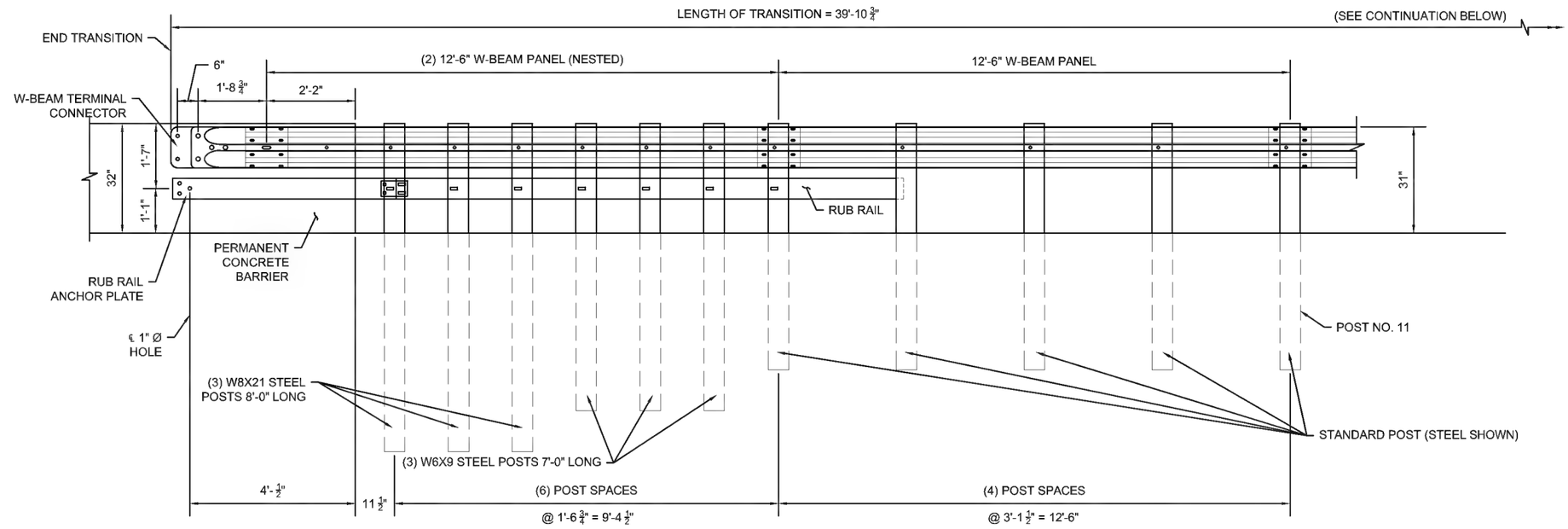
TRANSITION TO NCHRP 350 GUARDRAIL

DATE OF ISSUE
OCTOBER 2017

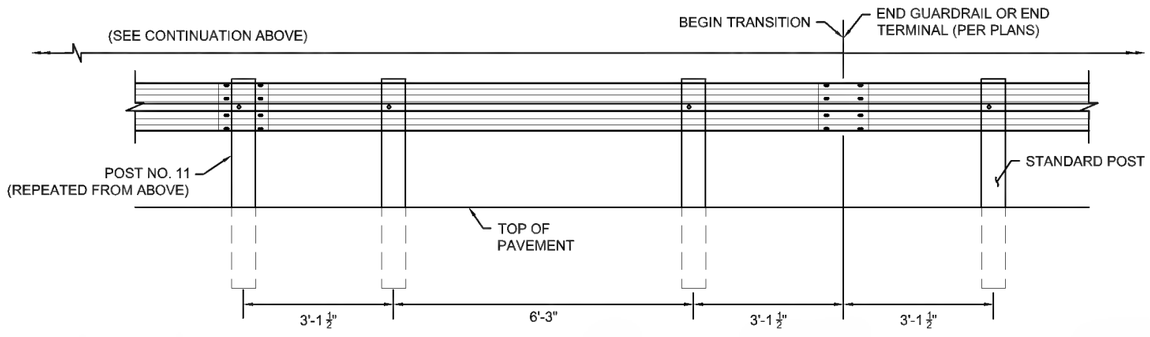
DRAWING NUMBER
400.3.1



PLAN



ELEVATION



ELEVATION

NOTES:

1. SEE SHEET 400.3.4 FOR COMPONENT DETAILS.
2. BOLT RUB RAIL TO POST WITHOUT WASHER.
3. POSTS WITH RUB RAIL ATTACHMENT REQUIRE AN ADDITIONAL HOLE.
4. STEEL SPACER TUBE, SCHEDULE 40 GALVANIZED PIPE, 6" ID X 12". CONNECT TO THE W-BEAM PANEL ELEMENTS USING SPLICE BOLT.

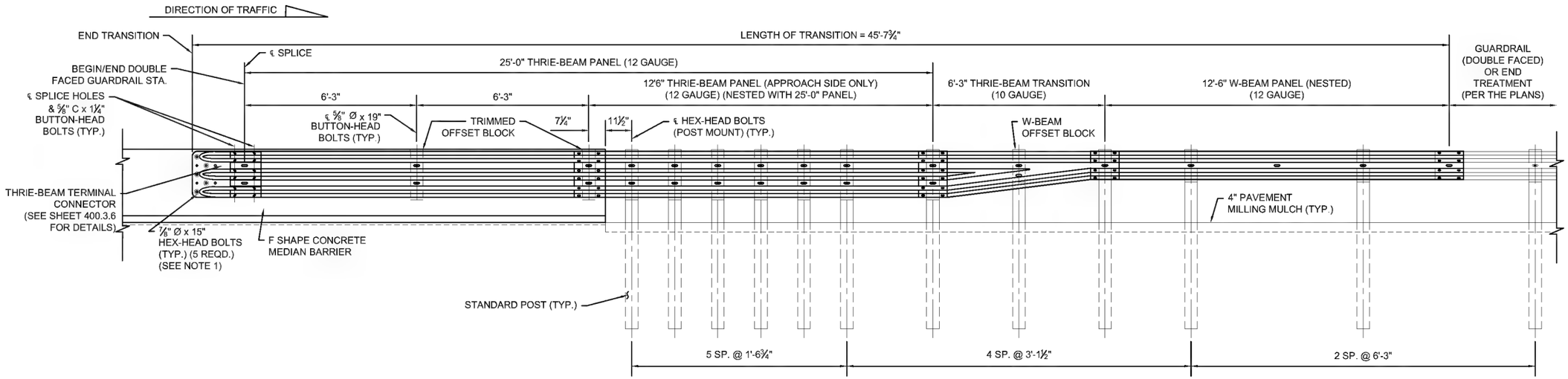
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

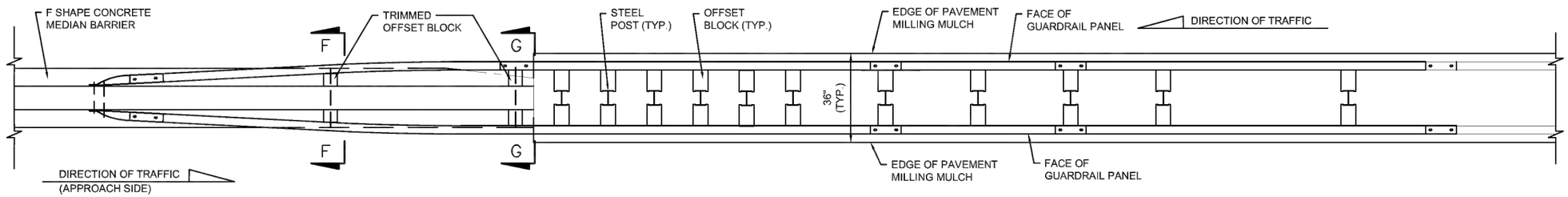
TRANSITION TO RIGID BARRIER (SINGLE FACED)

DATE OF ISSUE
OCTOBER 2017

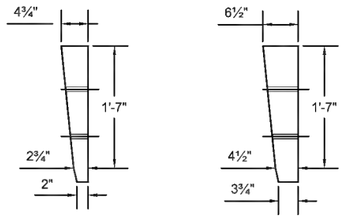
DRAWING NUMBER
400.3.2



ELEVATION (APPROACH SIDE)

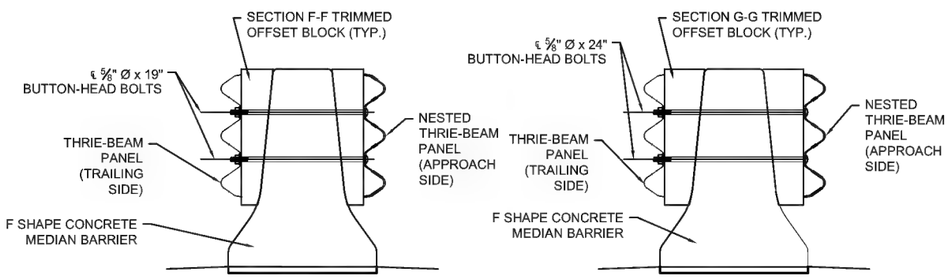


PLAN



SECTION F-F SECTION G-G

TRIMMED OFFSET BLOCKS (TIMBER ONLY)



SECTION F-F SECTION G-G

NOTES:

1. SEE SHEET 400.3.4 FOR CONSTRUCTION DETAILS OF THE THRIE-BEAM TERMINAL CONNECTOR. THE INSTALLED BOLT'S THREADED PORTION IS NOT PERMITTED TO EXTEND BEYOND ¾" FROM THE FACE OF THE NUT; TRIM THE THREADED PORTION AS NEEDED AND GALVANIZE IN ACCORDANCE WITH M8.07.0.

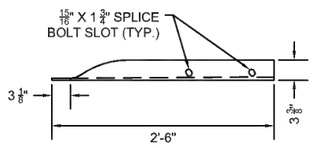
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

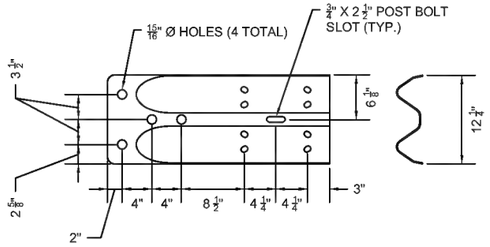
TRANSITION TO RIGID BARRIER (DOUBLE FACED)

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
400.3.3

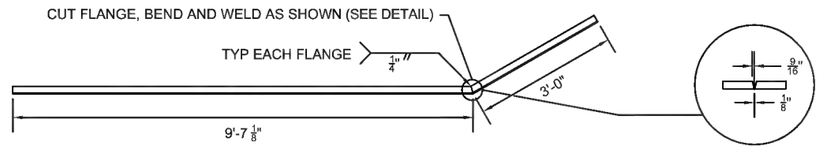


PLAN

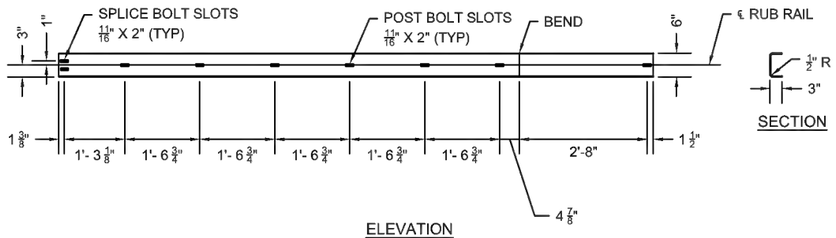


ELEVATION

TERMINAL CONNECTOR

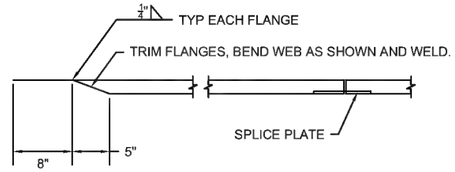


PLAN

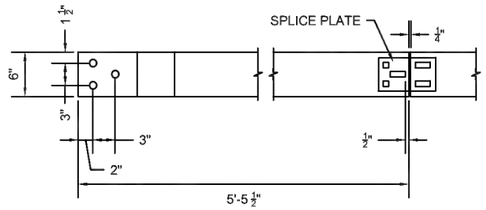


ELEVATION SECTION

C6 X 8.2 RUB RAIL

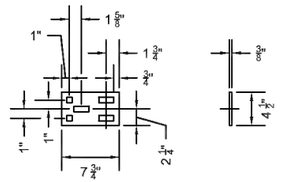


PLAN



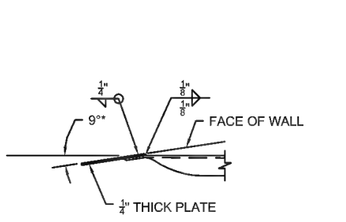
ELEVATION

RUB RAIL - END DETAIL



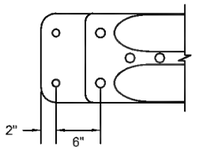
ELEVATION SECTION

SPLICE PLATE



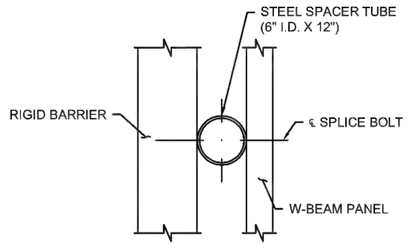
* OR TO BE DETERMINED BY THE ENGINEER

PLAN

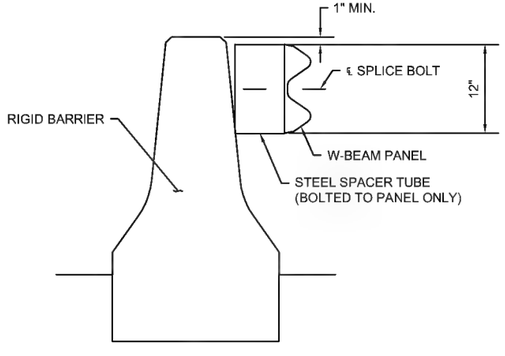


ELEVATION

TERMINAL CONNECTOR TO RIGID BARRIER CONNECTION

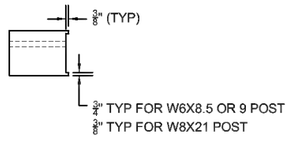


PLAN

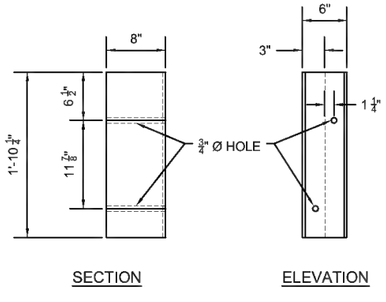


SECTION

STEEL SPACER TUBE

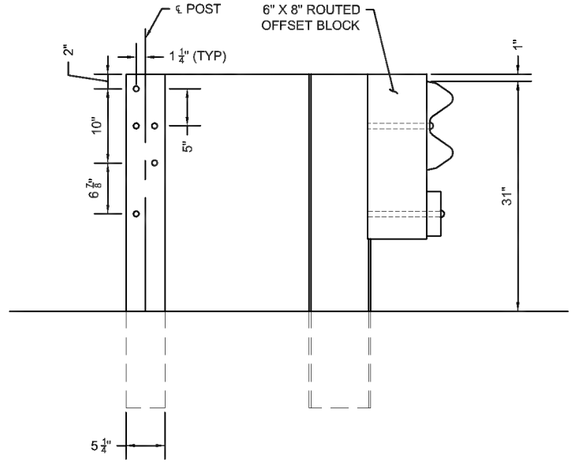


PLAN



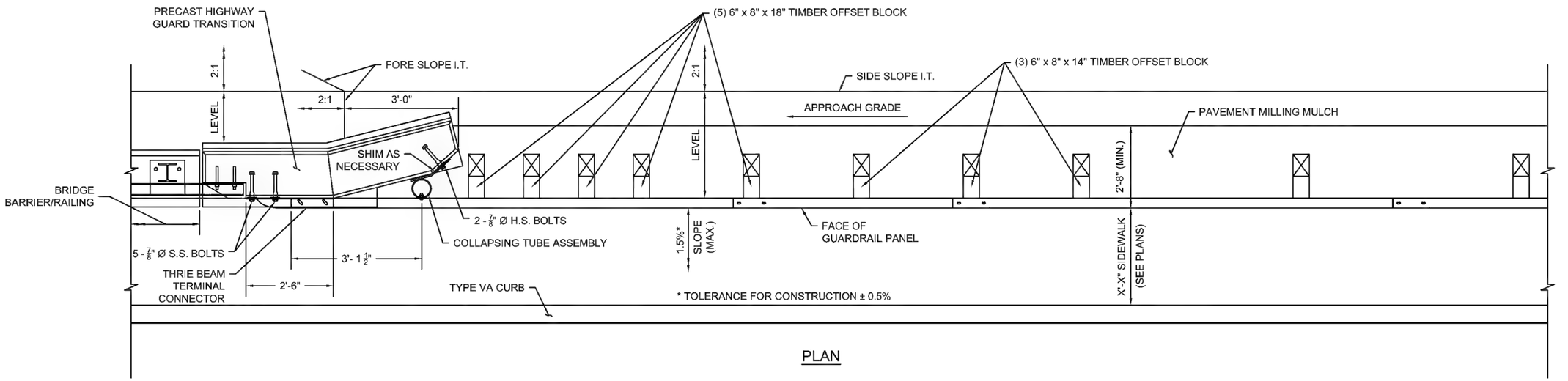
SECTION ELEVATION

OFFSET BLOCK

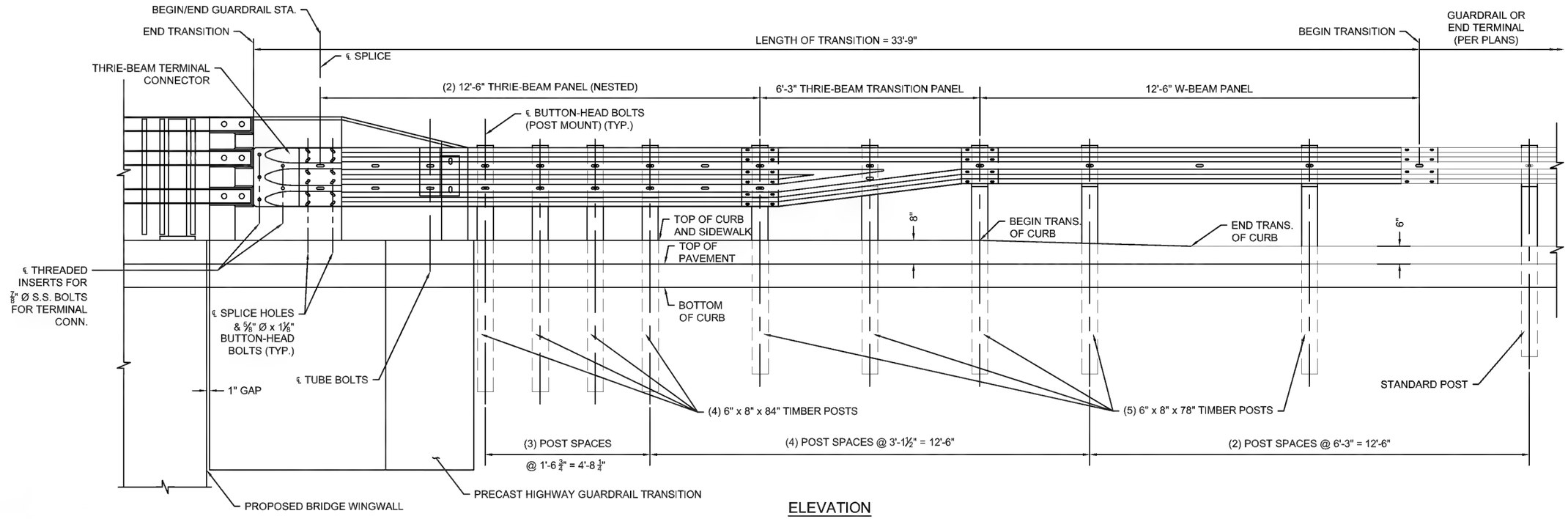


ELEVATION SECTION

POST



PLAN



ELEVATION

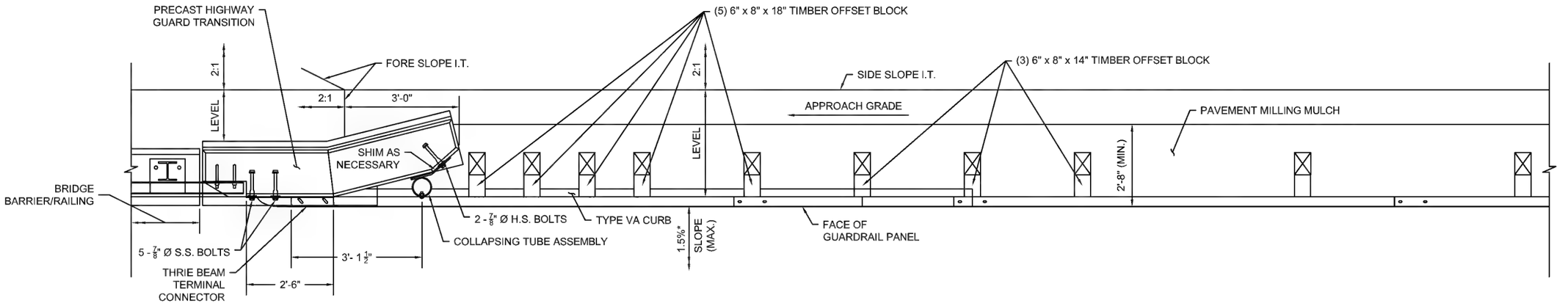
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

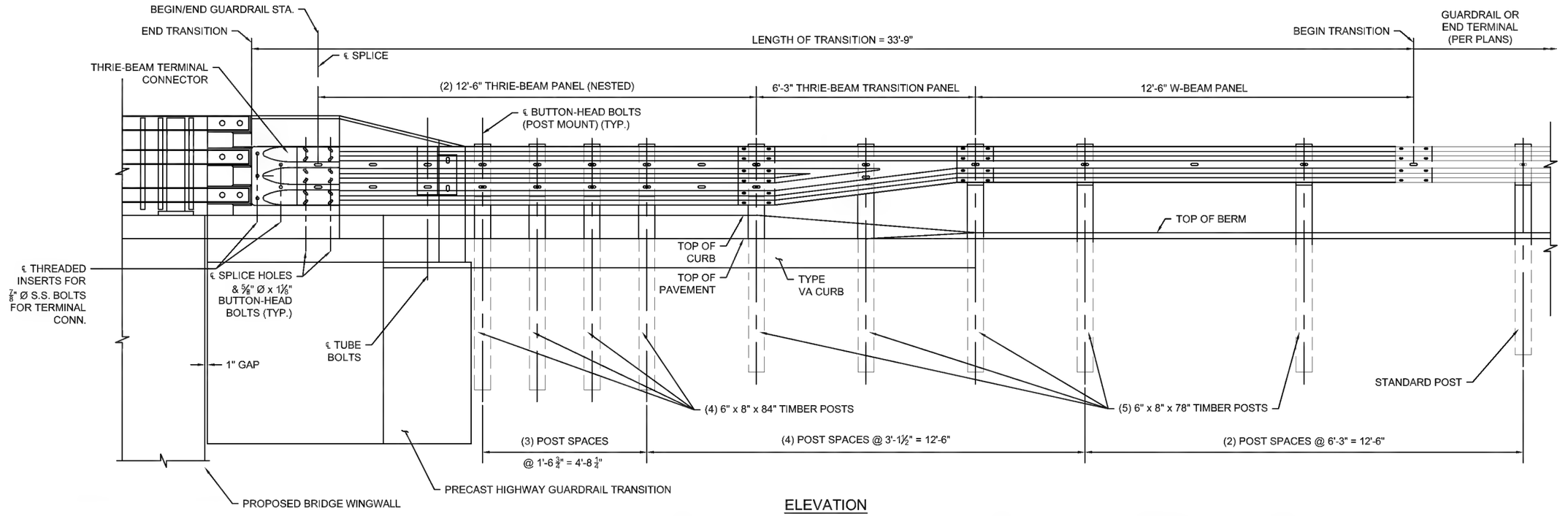
TRANSITION TO BRIDGE RAIL (BACK OF SIDEWALK)

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
400.3.5



PLAN



ELEVATION

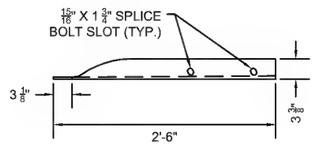
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

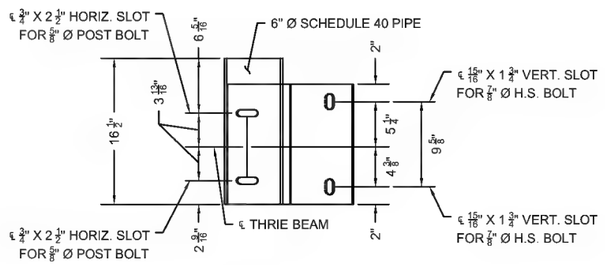
TRANSITION TO BRIDGE RAIL (FACE OF CURB)

DATE OF ISSUE
OCTOBER 2017

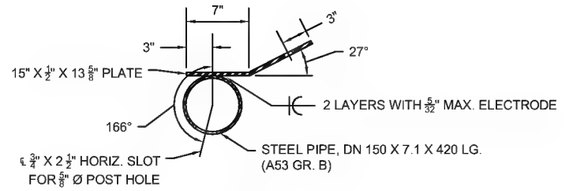
DRAWING NUMBER
400.3.6



PLAN

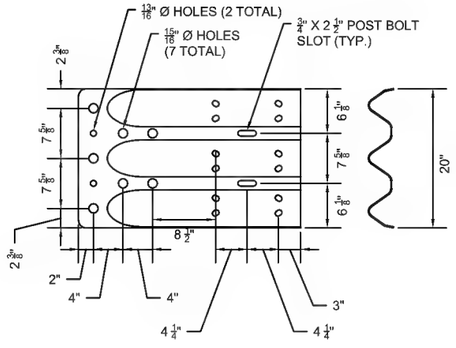


ELEVATION



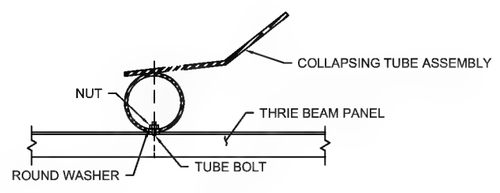
PLAN

COLLAPSING TUBE ASSEMBLY



ELEVATION

TERMINAL CONNECTOR



PLAN

RAIL/TUBE CONNECTION

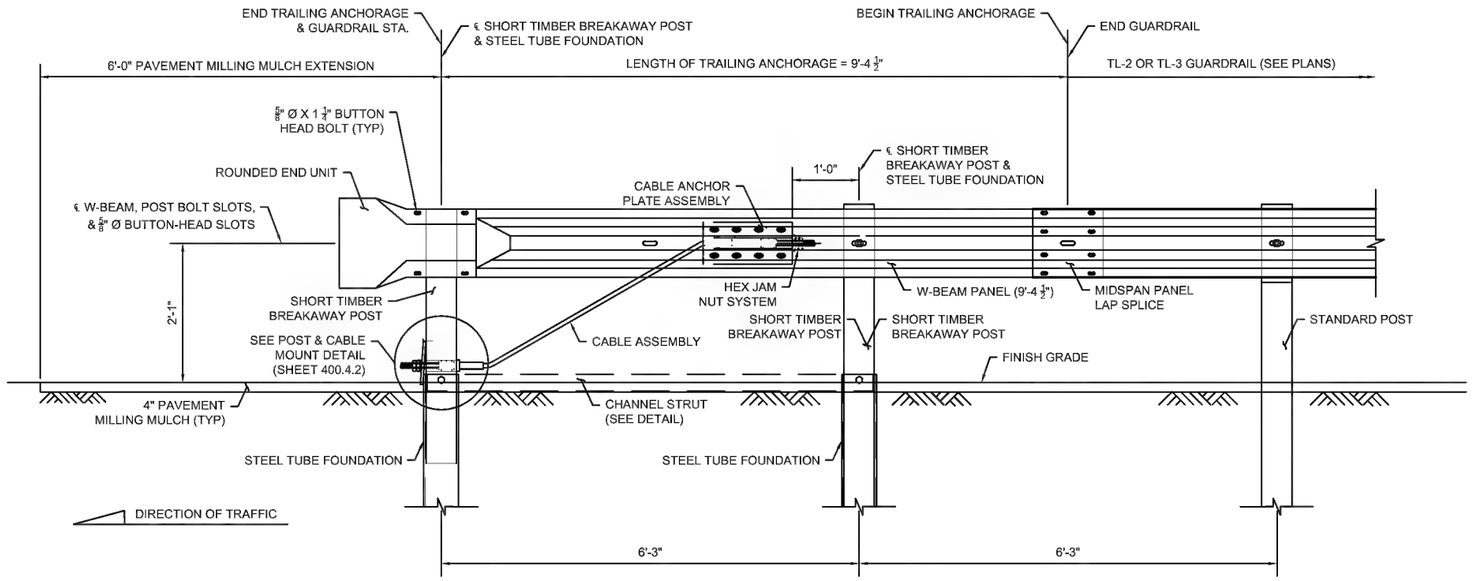
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

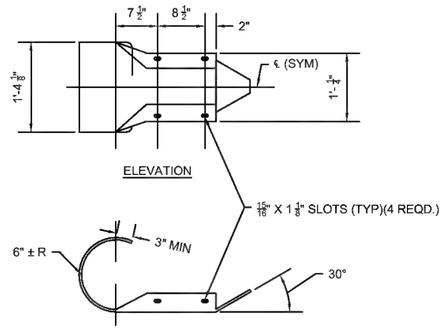
TRANSITION TO BRIDGE RAIL DETAILS

DATE OF ISSUE
OCTOBER 2017

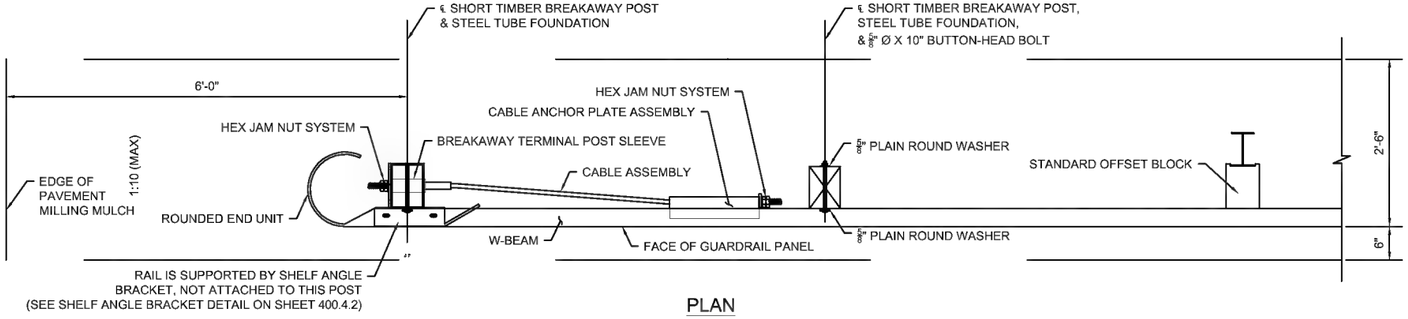
DRAWING NUMBER
400.3.7



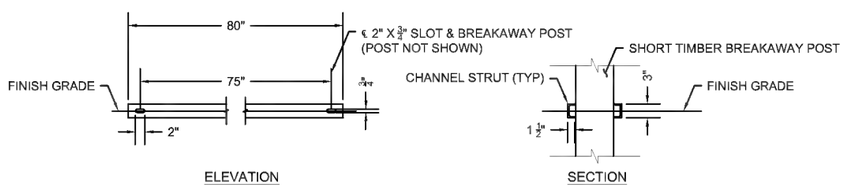
ELEVATION



ROUNDED END UNIT



PLAN



CHANNEL STRUT

NOTES:

1. FOR ADDITIONAL DETAILS, SEE 400.4.2.
2. LAP THE ROUNDED END UNIT OVER THE FACE OF THE W-BEAM PANEL.
3. INSTALL STEEL TUBE FOUNDATIONS BY ONE OF THE FOLLOWING METHODS:

A. EXCAVATE, INSTALL TUBE, BACKFILL, AND SUITABLY COMPACT MATERIALS; OR

B. DRIVE THE TUBE USING A DUMMY TIMBER POST TO PREVENT DAMAGE TO THE SHORT BREAKAWAY POST.

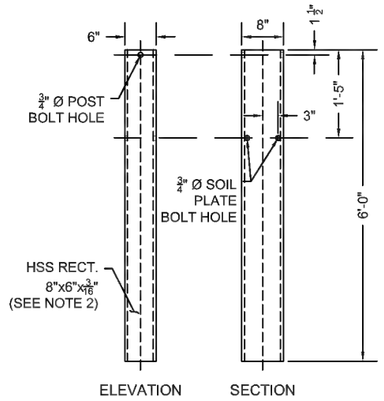
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS
SECTION 400

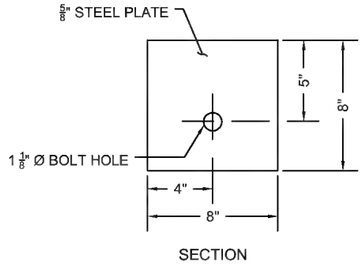
TRAILING ANCHORAGE

DATE OF ISSUE
OCTOBER 2017

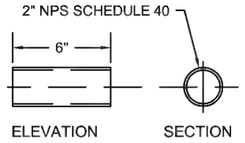
DRAWING NUMBER
400.4.1



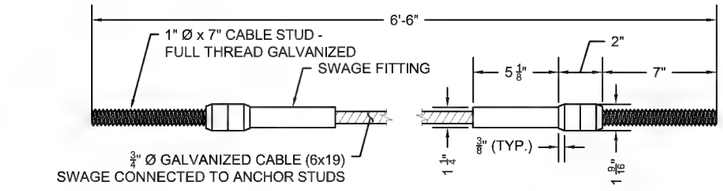
STEEL TUBE FOUNDATION



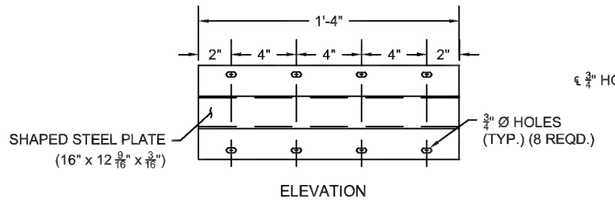
BCT BEARING PLATE

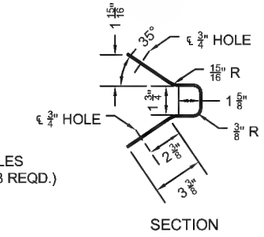


BREAKAWAY TERMINAL POST SLEEVE

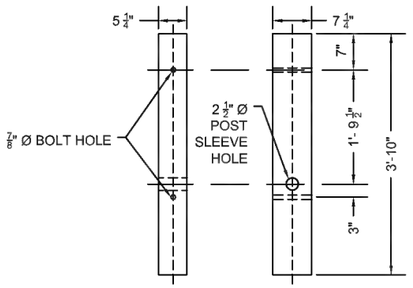


CABLE ASSEMBLY

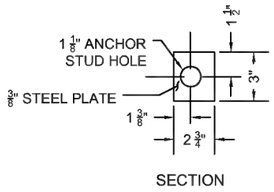




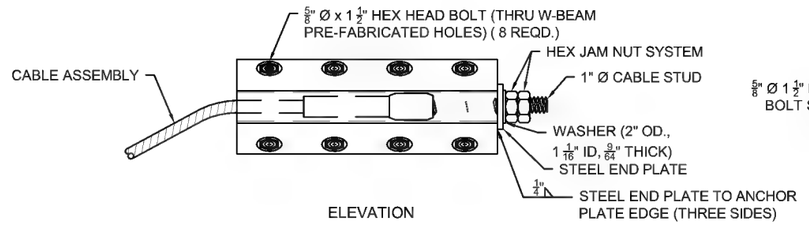
CABLE ANCHOR PLATE

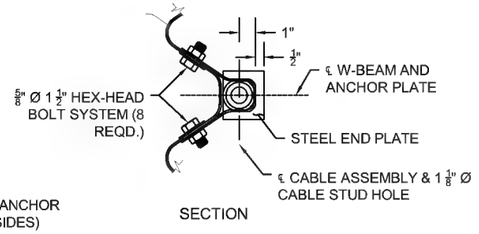


SHORT TIMBER BREAKAWAY POST
(6"x8" NOM.)

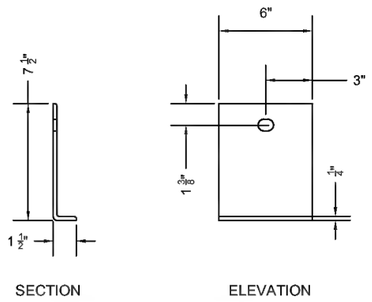


STEEL END PLATE

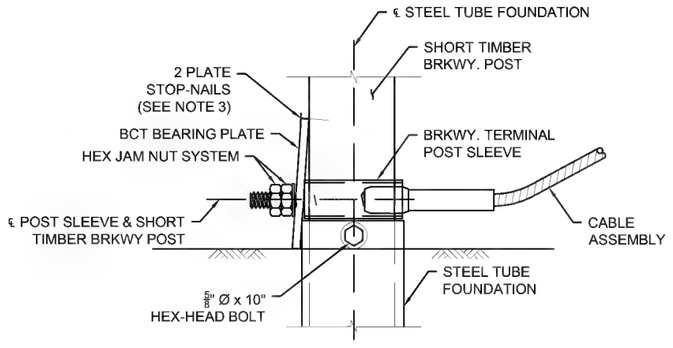




CABLE ANCHOR PLATE ASSEMBLY



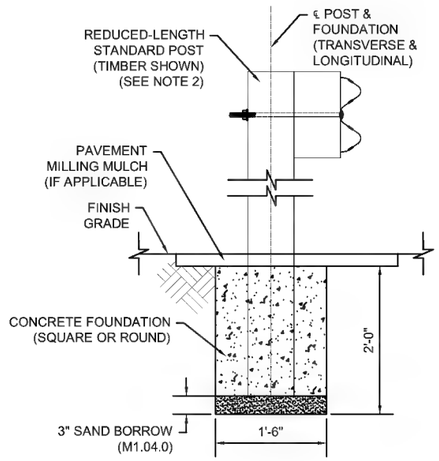
SHELF ANGLE BRACKET



POST & CABLE MOUNT ASSEMBLY

NOTES:

1. COMPONENTS SHALL BE INSTALLED PER 400.4.1.
2. HEX NUTS, HEX JAM NUTS AND WASHERS SHALL BE IN ACCORDANCE WITH AASHTO-ARTBA-AGC *A GUIDE TO STANDARDIZING HIGHWAY BARRIER HARDWARE*. TWO HEX NUTS MAY BE USED FOR THE HEX JAM SYSTEM.
3. DRIVE TWO ASTM A153 HOT DIP GALVANIZED STEEL 2 1/2" TYPE 8D NAILS TO PREVENT ROTATION OF THE BCT BEARING PLATE.

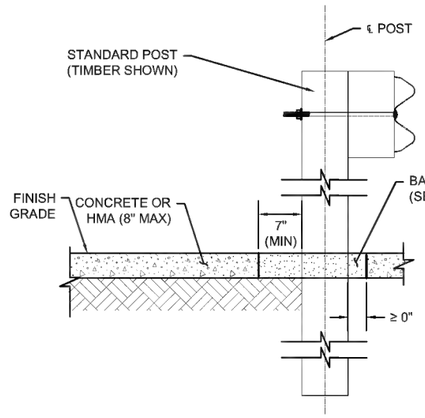


SECTION

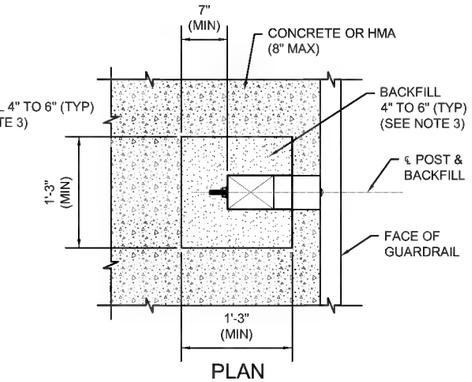
ENCASED POST FOR SHALLOW MOUNT

NOTES:

1. WHEN THE CONSTRUCTION OF GUARDRAIL AT THE REQUIRED POST SPACING RESULTS IN POST(S) CONFLICTING WITH UNDERGROUND UTILITIES OR OTHER UNDERGROUND OBSTRUCTIONS, AN ENCASED POST MAY BE USED WHERE A 2'-0" DEPTH WILL AVOID THE CONFLICT. INSTALL WHERE SHOWN IN THE PLANS AND/OR AS-NEEDED.
2. USE A STANDARD POST WITH REDUCED LENGTH SUCH THAT THE PANEL HEIGHT IS MAINTAINED WHILE THE POST BOTTOM TERMINATES AT THE BOTTOM OF THE CONCRETE FOUNDATION AT THE TOP OF THE 3" (MIN) SAND BORROW.
3. CONCRETE FOUNDATION SHALL BE 3500 PSI, CEMENT CONCRETE (M4.02.00). AFTER CASTING THE CONCRETE, ENSURE THE SURROUNDING SOIL MATERIAL IS COMPLETELY BACKFILLED AND TAMPED TO PROVIDE FULL PASSIVE RESISTANCE.
4. ENCASED POSTS ARE NOT PERMITTED FOR CONSECUTIVE POSTS UNLESS OTHERWISE SHOWN IN THE PLANS.



SECTION

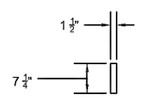


PLAN

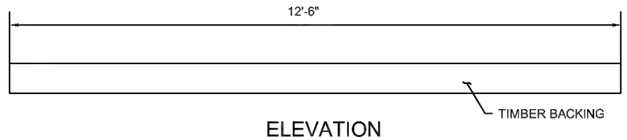
NOTES:

1. WHEN THE CONSTRUCTION OF GUARDRAIL AT THE REQUIRED POST SPACING RESULTS IN POST(S) PLACED WITHIN A CONCRETE OR HMA SURFACE, USE A FRANGIBLE LEAVE-OUT AROUND THE POST BASE AS SHOWN. INSTALL WHERE SHOWN IN THE PLANS AND/OR AS NEEDED.
2. FOR THE REQUIRED 1'-6" x 1'-6" LEAVE-OUT, SMOOTHLY CUT THE EXISTING CONCRETE OR HMA SURFACE OR FORM-UP THE SQUARE SHAPE WHEN AN APPLICATION HAS NEW SURROUNDING CONCRETE.
3. USE AN EXCAVATABLE CONTROLLED DENSITY FILL (M4.08.0 TYPE 1E OR 2E) OR COMPACTED GRAVEL BORROW (M1.03.0 TYPE C) FOR BACKFILL.
4. ENSURE FILL MATERIAL SURFACE IS SMOOTH AND EVEN WITH THE ADJACENT SURFACE.

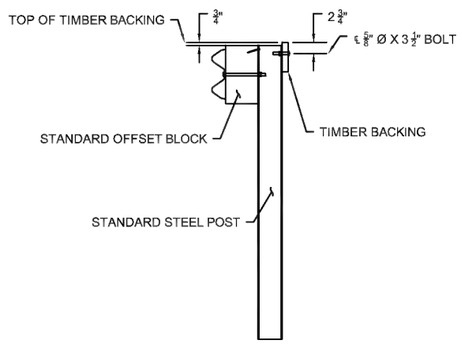
FRANGIBLE LEAVE-OUT FOR CONCRETE OR HMA SURFACE



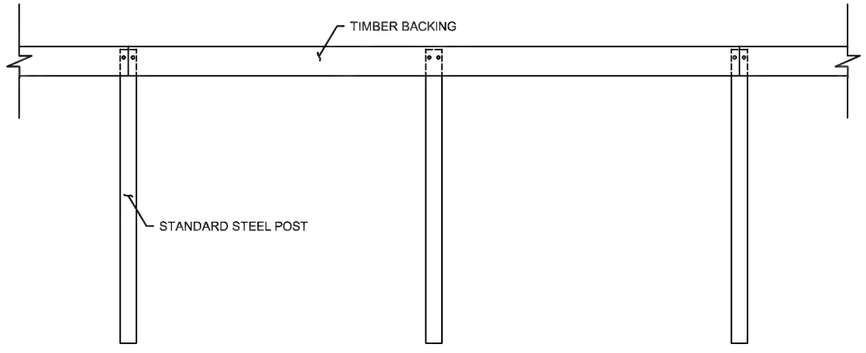
SECTION



ELEVATION



SECTION

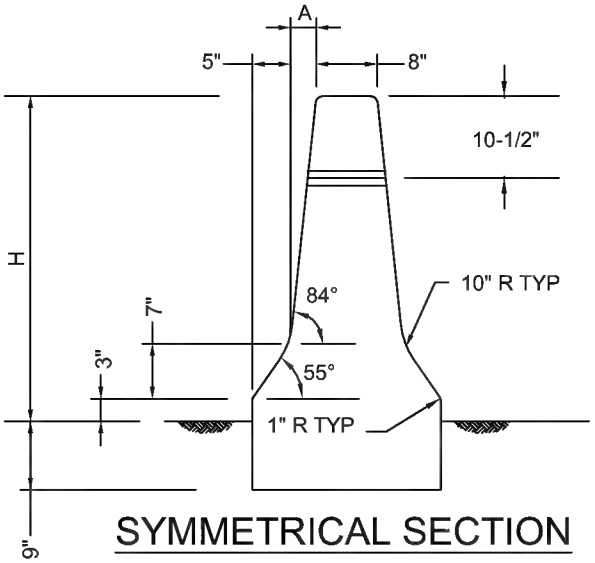


ELEVATION

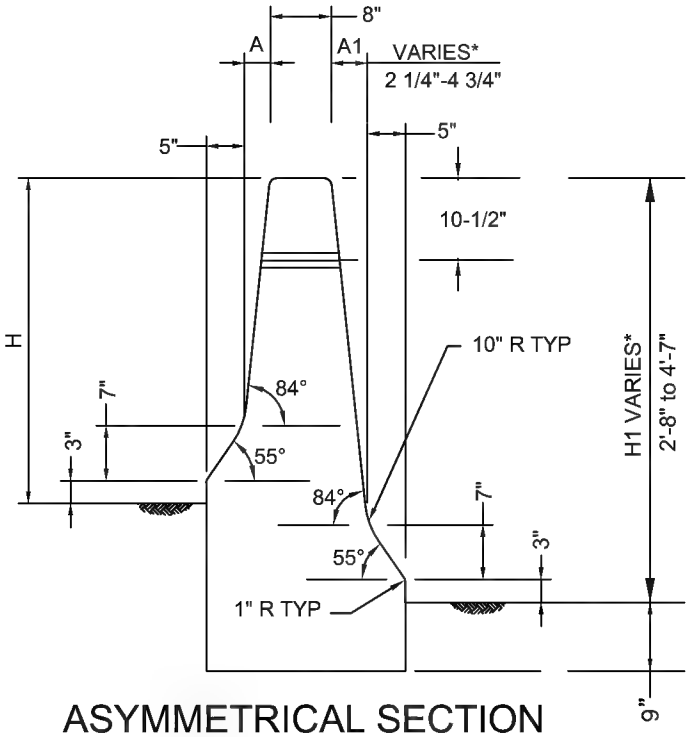
NOTES:

1. TIMBER BACKING SHALL CONFORM TO M9.05.3.
2. BACKING SHALL NOT BE INSTALLED WITHIN 50 FEET OF AN END TERMINAL

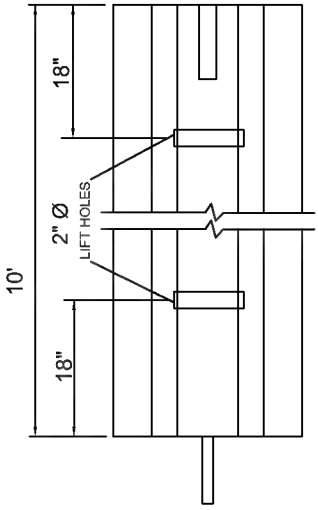
TIMBER BACKING FOR STEEL POSTS ADJACENT TO MULTI-USE PATHS



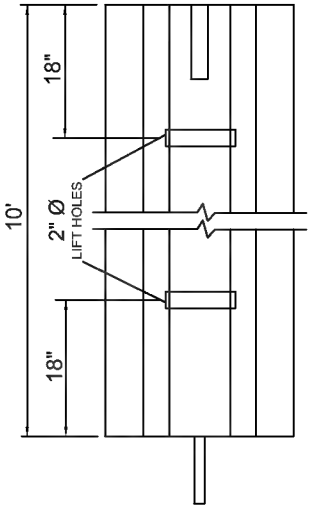
SYMMETRICAL SECTION



ASYMMETRICAL SECTION



PLAN



PLAN

SYSTEM	A	H
NORMAL	2 1/4"	2'-8"
TALL	3 1/4"	3'-6"

NOTES:

1. ALL EDGES SHALL BE ROUNDED WITH A 1" RADIUS EXCEPT AS SHOWN
2. FOR DOWEL CONNECTION DETAILS SEE E 402.13.0.
3. FOR REINFORCING SEE E 402.11.0 FOR SYMMETRICAL SHAPE AND E 401.12.0 FOR ASYMMETRICAL SHAPE.
4. ALL CONCRETE IS TO BE FIELD COATED AFTER FINAL INSTALLATION WITH A CONCRETE PENETRANT/SEALER. CAST IN PLACE CONCRETE SHALL CURE NOT LESS THAN 28 DAYS PRIOR TO COATING.
5. LIFT HOLES USED ONLY ON PRECAST BARRIERS 13' AND LESS.

* VARY "A1" RELATIVE TO "H1" WHILE MAINTAINING 55° AND 84° BARRIER ANGLES. A1=4-3/4" MAX., H1=4'-7" MAX.

massDOT Massachusetts Department of Transportation Highway Division
CONSTRUCTION STANDARDS

F SHAPE CONCRETE BARRIER

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 402.10.0

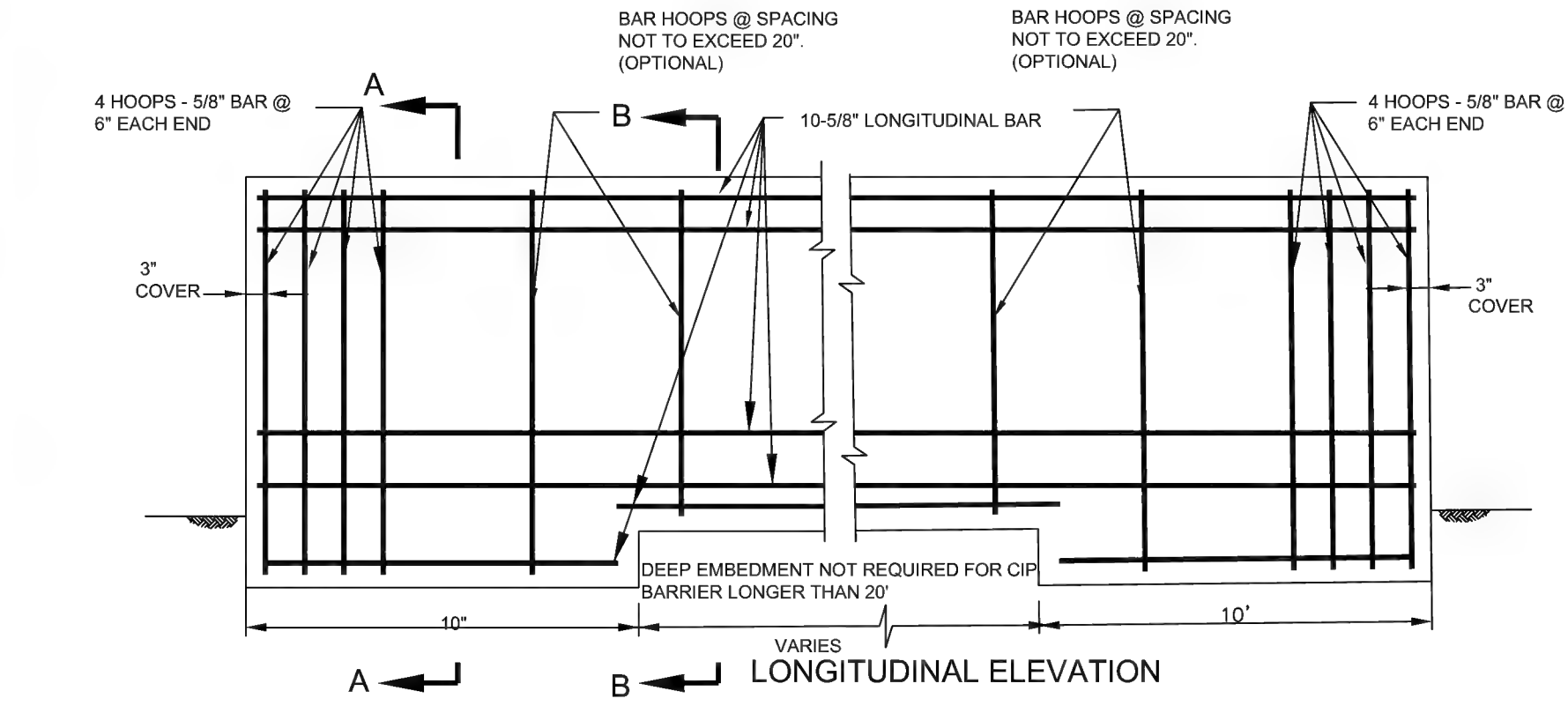
CONSTRUCTION STANDARDS

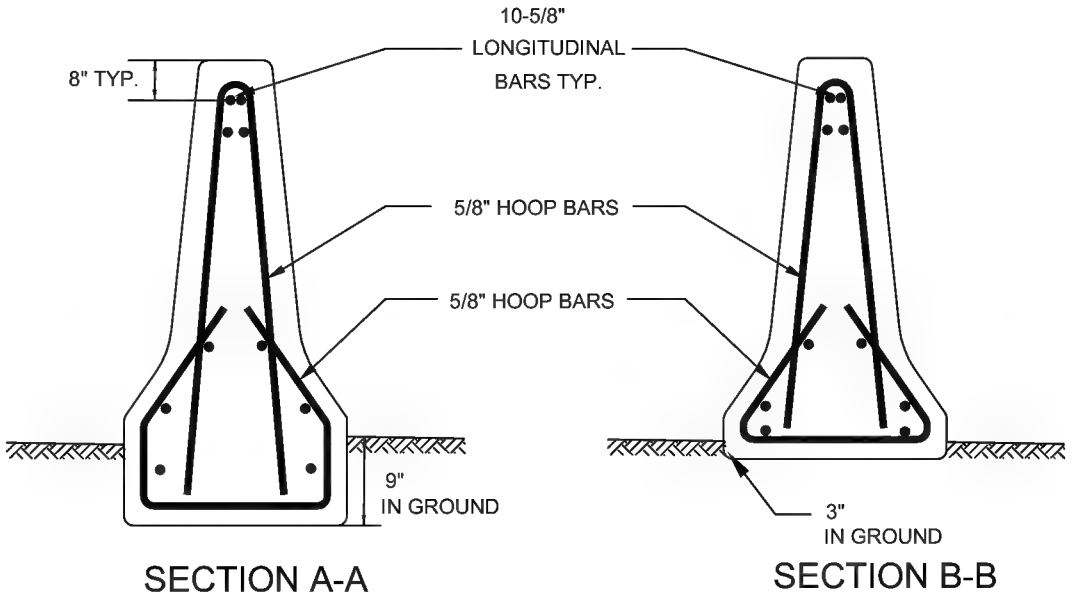
massDOT Highway Division Massachusetts Department of Transportation

F SHAPE CONCRETE BARRIER
SYMMETRICAL SECTION
REINFORCING DETAILS

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 402.11.0





NOTES:

1. CAST IN PLACE NOT TO EXCEED 200' BETWEEN EXPANSION JOINTS.
2. CONSTRUCTION JOINTS REQUIRED AT 40' INTERVALS (1/2 " PREMOULDED JOINT FILLER REQUIRED FOR PRECAST BARRIERS).
3. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
4. MATERIAL IS 4000 PSI CEMENT CONCRETE. (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
5. ALL STEEL REINFORCING TO BE GALVANIZED OR EPOXY COATED, AASHTO-M31, GRADE 60.
6. ALL LONGITUDINAL BARS ARE TO BE CONTINUOUS FOR BOTH PRECAST AND CAST IN PLACE BARRIERS.
7. FOR DIMENSIONS SEE E 402.10.0

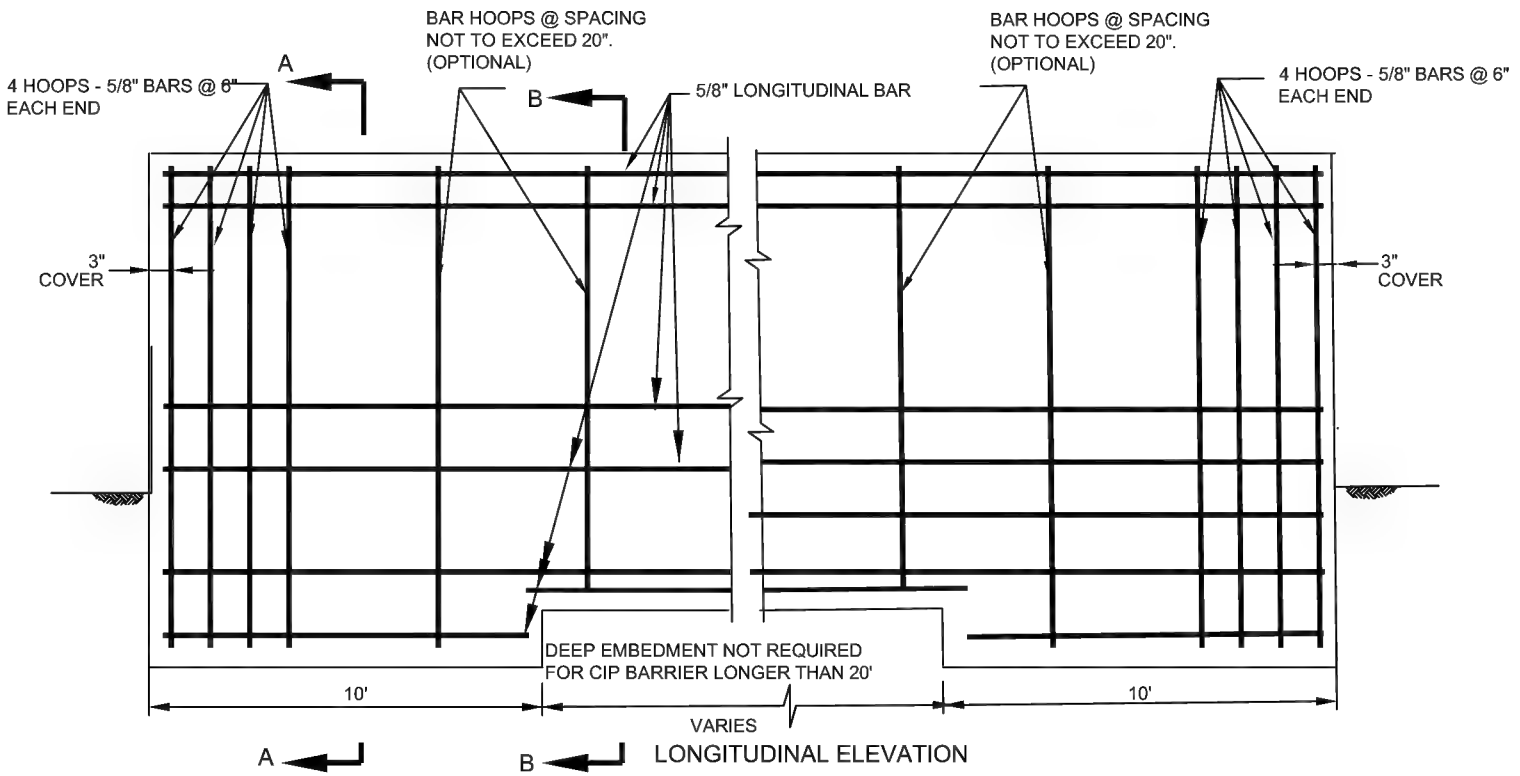
CONSTRUCTION STANDARDS

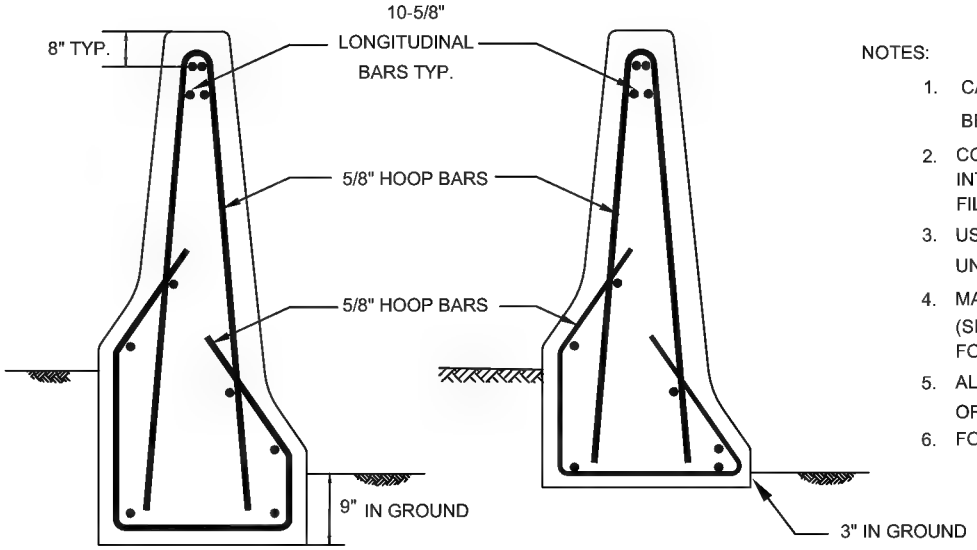
massDOT Massachusetts Department of Transportation Highway Division

F SHAPE CONCRETE BARRIER
ASYMMETRICAL SECTION
REINFORCING DETAILS

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 402.12.0





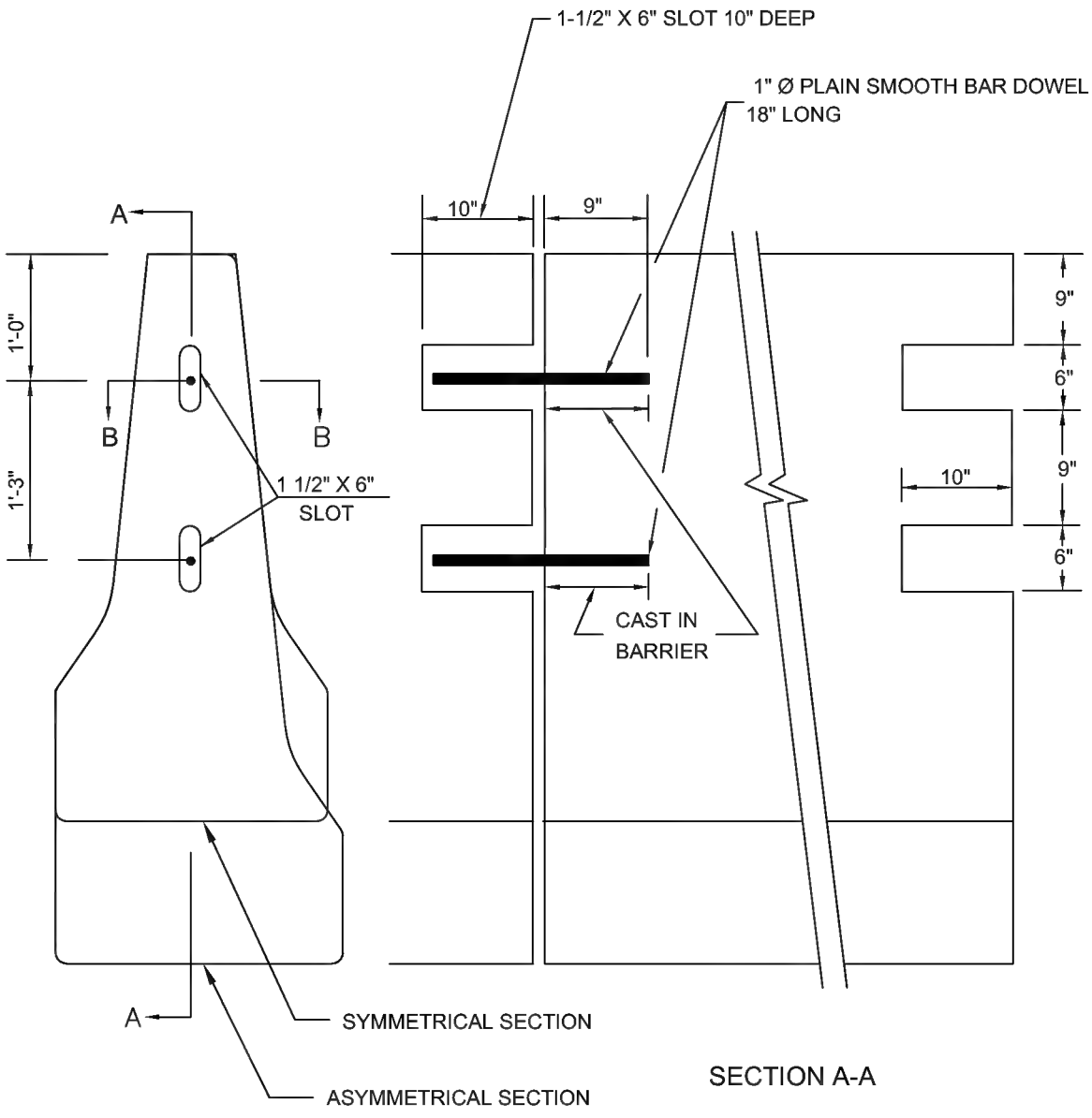
NOTES:

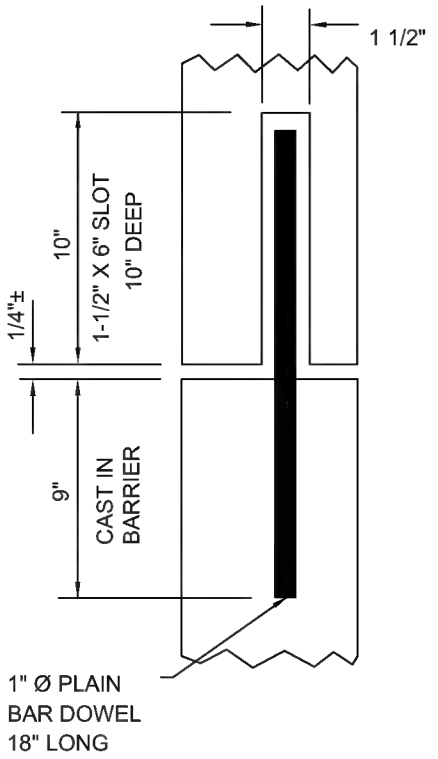
1. CAST IN PLACE NOT TO EXCEED 200' BETWEEN EXPANSION JOINTS.
2. CONSTRUCTION JOINTS REQUIRED AT 40' INTERVALS (1/2 " PREMOULDED JOINT FILLER REQUIRED FOR PRECAST BARRIERS).
3. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
4. MATERIAL IS 4000 PSI CEMENT CONCRETE. (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS)
5. ALL STEEL REINFORCING TO BE GALVANIZED OR EPOXY COATED, AASHTO-M31, GRADE 60.
6. FOR DIMENSIONS SEE E 402.10.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

F SHAPE CONCRETE BARRIER
DOWEL DETAILS





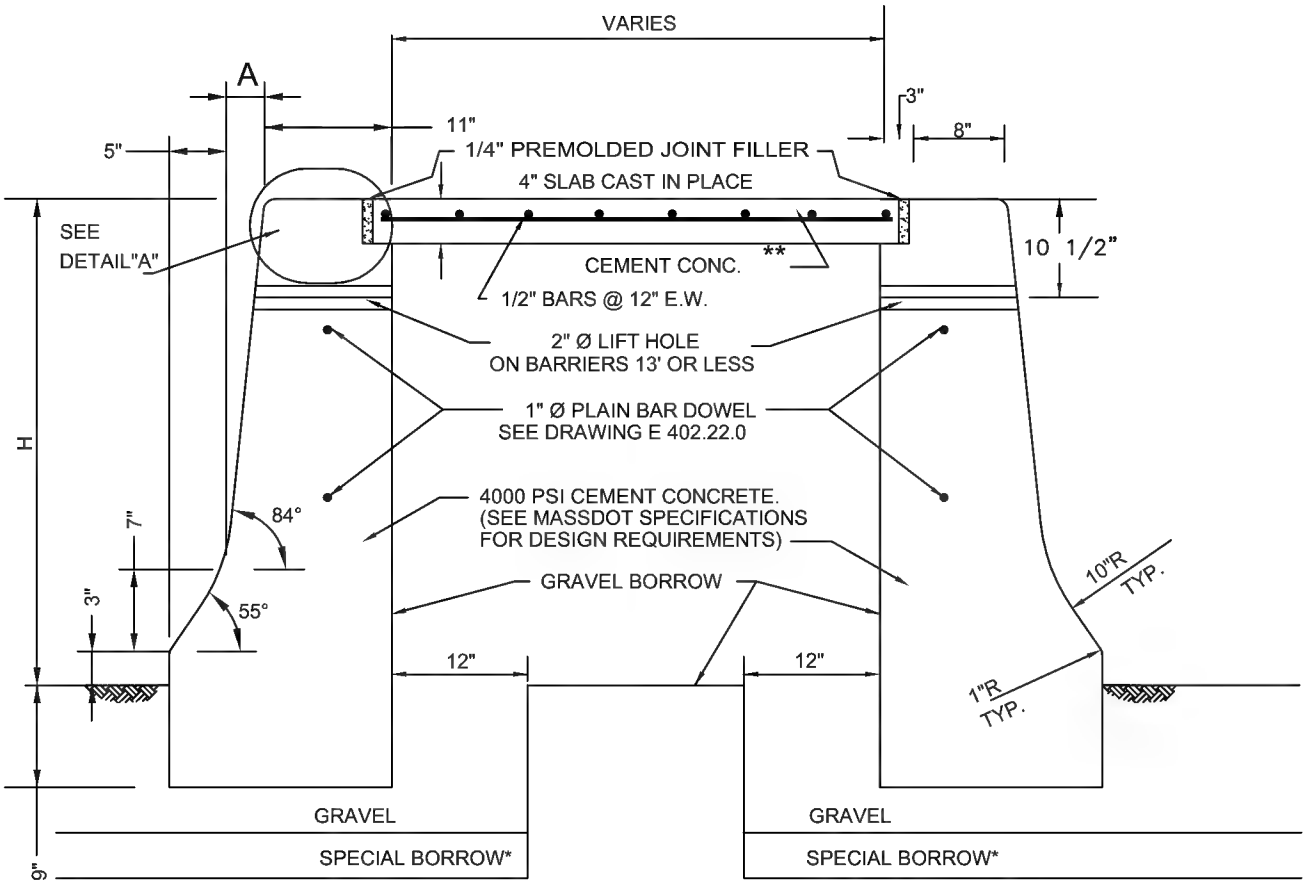
SECTION B-B

NOTES:

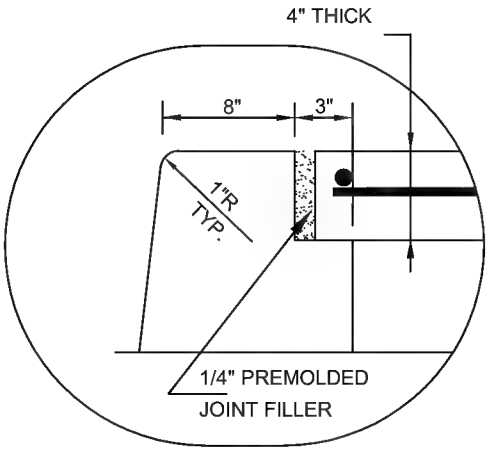
1. DOWELS TO BE GALVANIZED, AASHTO-M31, GRADE 60.
2. FOR ADDITIONAL DETAILS SEE E 402.10.0

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 402.13.0



SYSTEM	A	H
NORMAL	2-3/8"	2'-8"
TALL	3-11/32"	3'-6 1/8"



DETAIL "A"

* SAME DEPTH AS UNDER ROADWAY.

** BARRIER CAP BUILT USING 4000 PSI CEMENT CONCRETE (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).

NOTES:

1. ALL LONGITUDINAL BARS TO BE CONTINUOUS FOR BOTH PRECAST BARRIERS AND CAST IN PLACE BARRIERS.
2. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
3. ALL CONCRETE IS TO BE FIELD COATED AFTER FINAL INSTALLATION WITH A CONCRETE PENETRANT/SEALER. CONCRETE SHALL CURE NOT LESS THAN 28 DAYS PRIOR TO COATING.
4. FOR REINFORCING DETAILS SEE E 402.21.0
5. FOR DOWEL DETAILS SEE E 402.22.0
6. TAR PAPER TO BE PLACED INSIDE LIFT HOLES AND BARRIER JOINTS.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 402.20.0

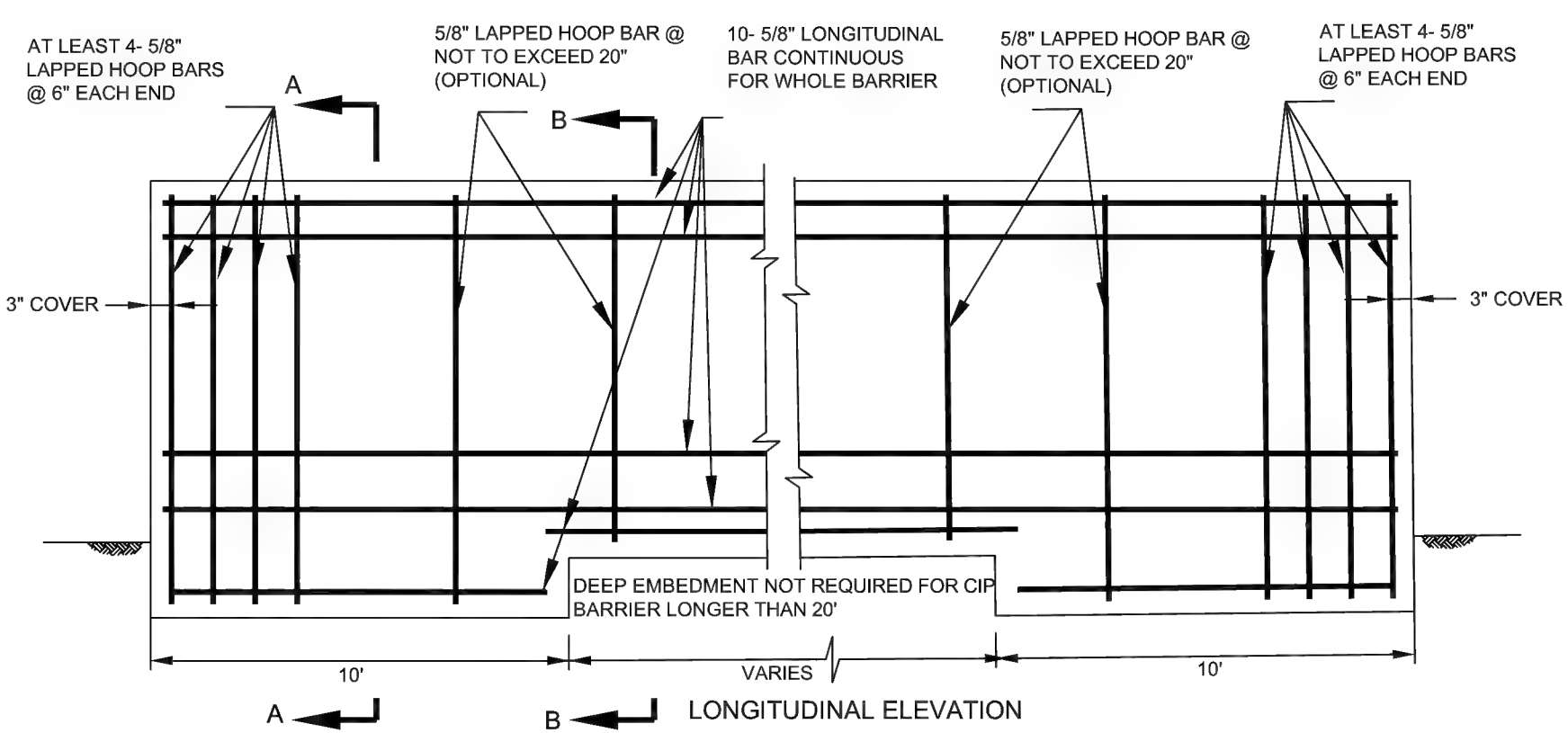
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

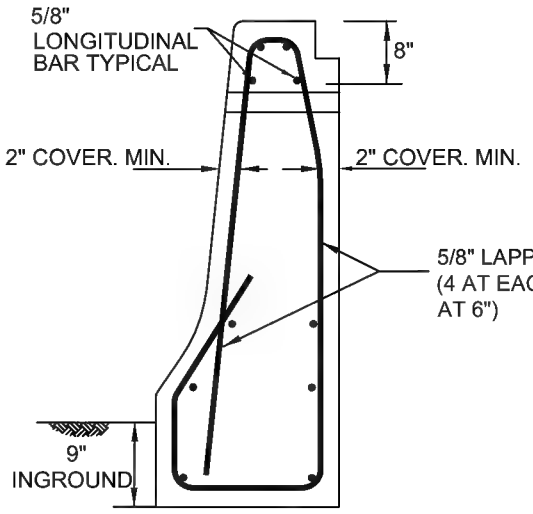
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR REINFORCING DETAILS

DRAWING NUMBER
E 402.21.0

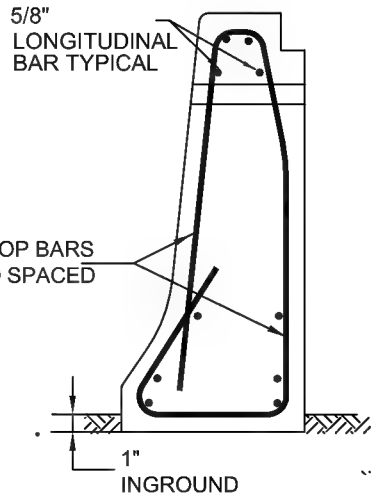
DATE OF ISSUE
OCTOBER 2017



LONGITUDINAL ELEVATION



SECTION A-A



SECTION B-B

NOTES:

1. ALL LONGITUDINAL BARS ARE TO BE CONTINUOUS FOR BOTH PRECAST BARRIERS AND CAST IN PLACE BARRIERS.
2. USE MINIMUM COVER OF 1 1/2", UNLESS OTHERWISE INDICATED.
3. CAST IN PLACE (CIP) NOT TO EXCEED 200 FT BETWEEN EXPANSION JOINTS.
4. CONTRACTION JOINTS REQUIRED AT 40' INTERVALS (1/2 " PREMOULDED JOINT FILLER REQUIRED FOR PRECAST BARRIERS).
5. ALL STEEL REINFORCING TO BE GALVANIZED OR EPOXY COATED, AASHTO-M31, GRADE 60.
6. FOR DIMENSIONS SEE E 401.20.0

NOTES:

1. DOWELS TO BE GALVANIZED, AASHTO M-31, GRADE 60.
2. FOR ADDITIONAL DETAILS SEE E 402.20.0

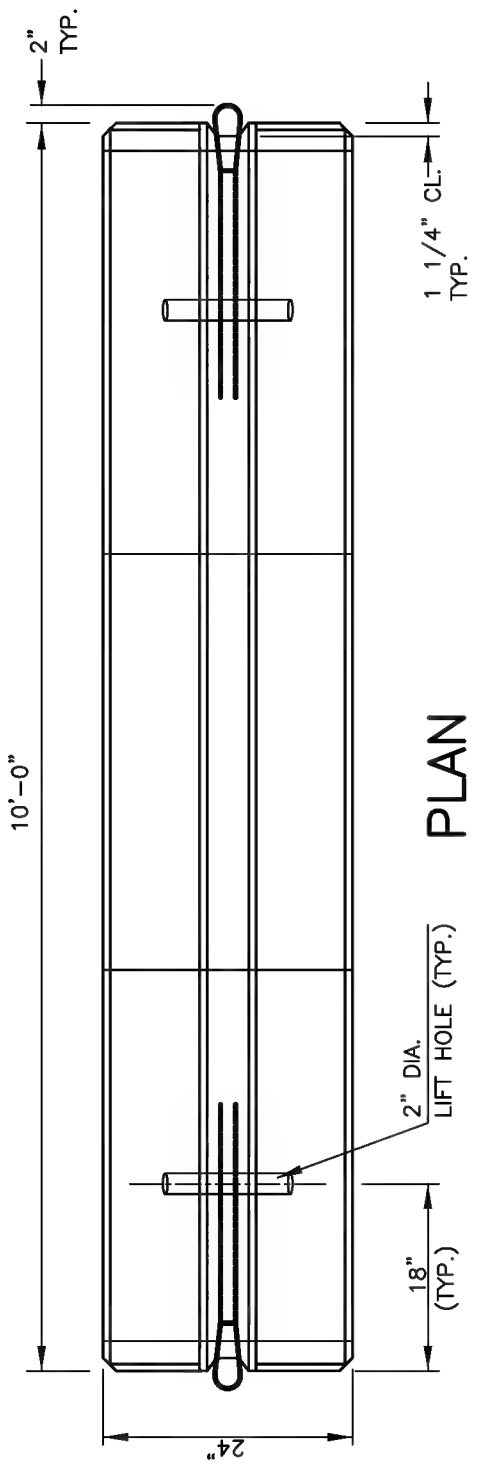
massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

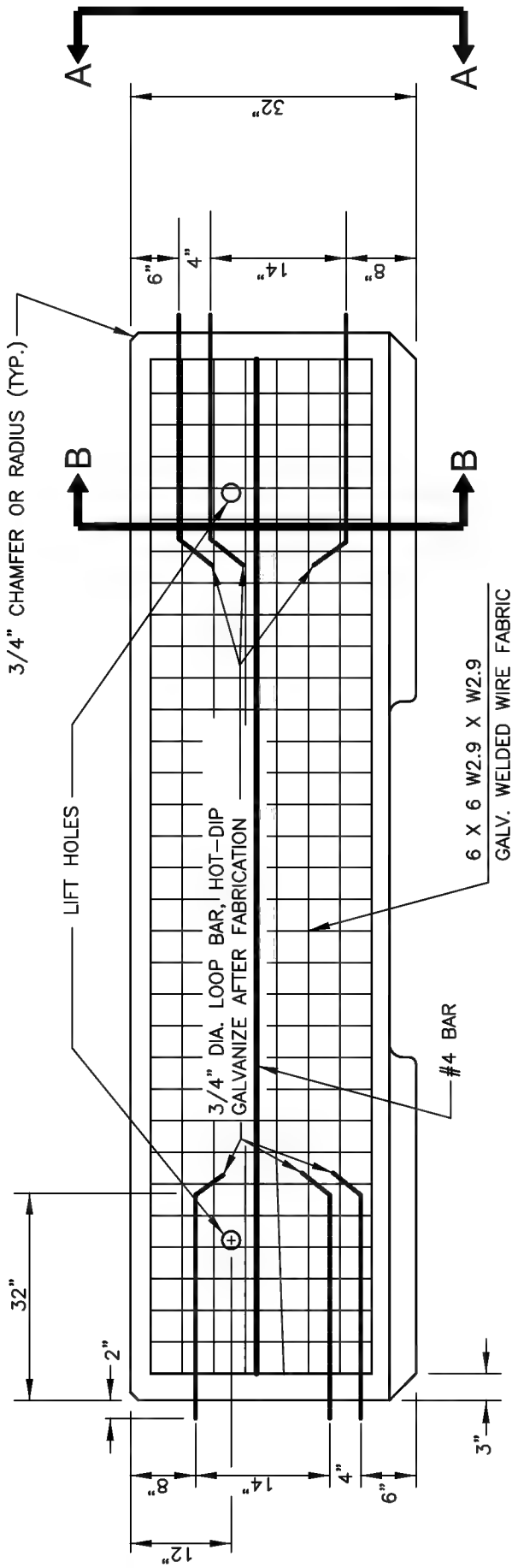
F SHAPE CONCRETE BARRIER WITH CONCRETE SEPARATOR DOWEL DETAILS

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 402.22.0



PLAN



ELEVATION

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

TEMPORARY CONCRETE BARRIER
MASH TL-2

1/3

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 403.1.0

CONSTRUCTION STANDARDS

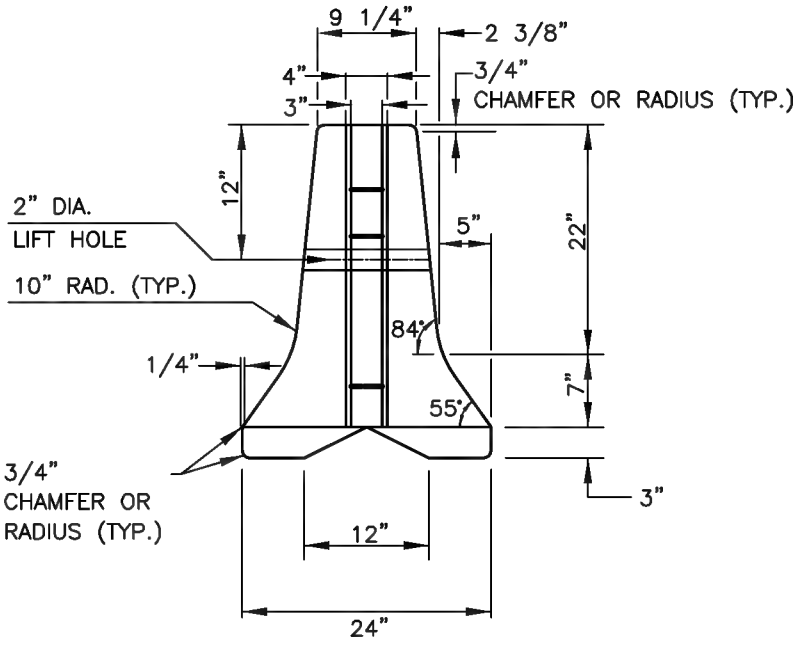
massDOT Massachusetts Department of Transportation Highway Division

TEMPORARY CONCRETE BARRIER
MASH TL-2

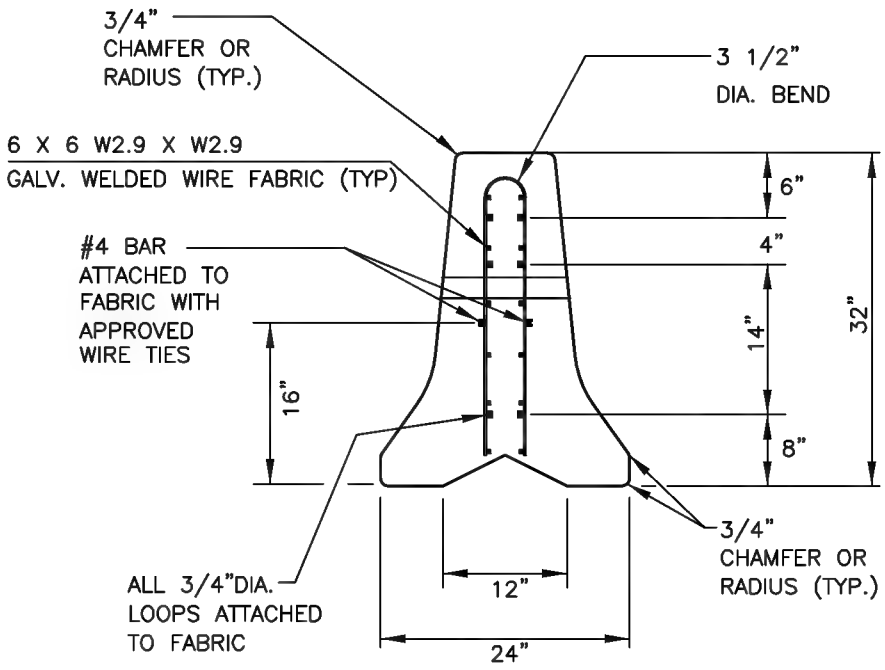
2/3

DRAWING NUMBER
E 403.2.0

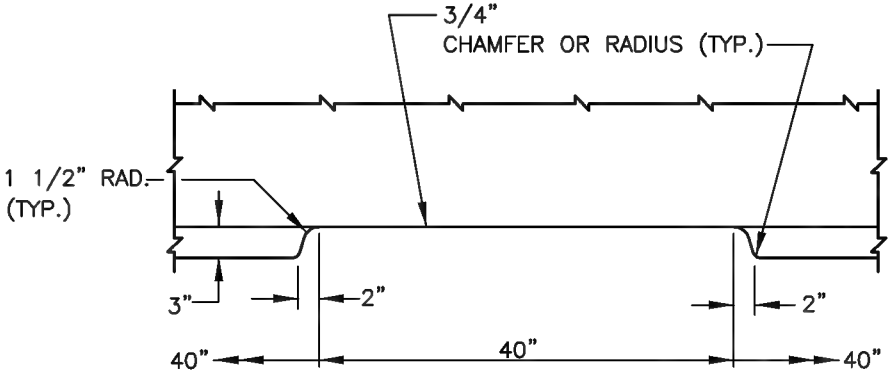
DATE OF ISSUE
OCTOBER 2017



END VIEW A–A



SECTION B–B



ELEVATION DETAIL OF DRAINAGE SLOT

TEST RESULTS
MASH 2–11 ON CONCRETE

1. INSTALLATION LENGTH: 20 SEGMENTS
2. DYNAMIC DEFLECTION AT BASE: 29.9"
3. PERMANENT DEFLECTION AT BASE: 29.0"
4. WORKING WIDTH: 53.0"

GENERAL NOTES

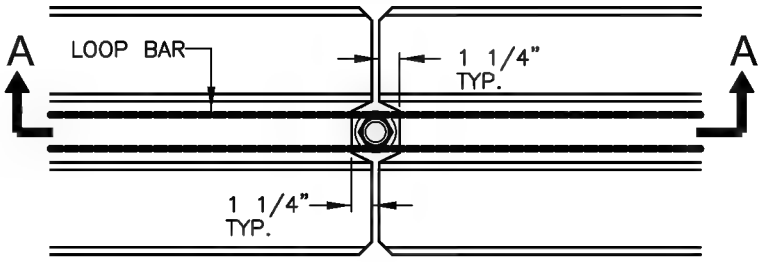
1. ALL WELDED WIRE FABRIC, BARS, HOOP BARS AND PIN ASSEMBLIES ARE TO BE HOT–DIP GALVANIZED AFTER FABRICATION.
2. HOT–DIP GALVANIZED TREATMENTS ARE TO CONFORM TO MASSDOT STANDARD SPECIFICATIOS M7.10.0 AND AASHTO M111.
3. CEMENT CONCRETE IS TO CONFORM TO MASSDOT STANDARD SPECIFICATIONS M4.02.00. CEMENT CONCRETE IS TO BE 5000 PSI (SEE MASSDOT SPECIFICATIONS FOR DESIGN REQUIREMENTS).

CONSTRUCTION STANDARDS

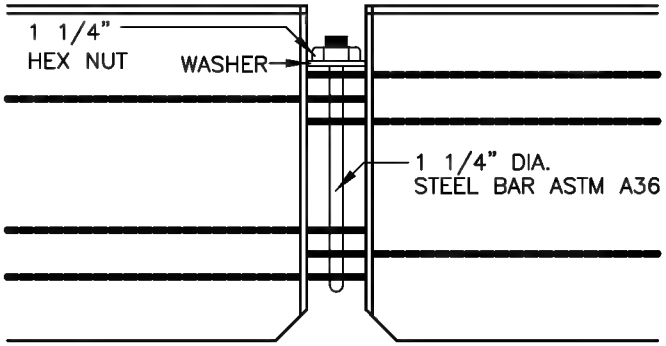
massDOT Highway Division
Massachusetts Department of Transportation

TEMPORARY CONCRETE BARRIER
MASH TL-2

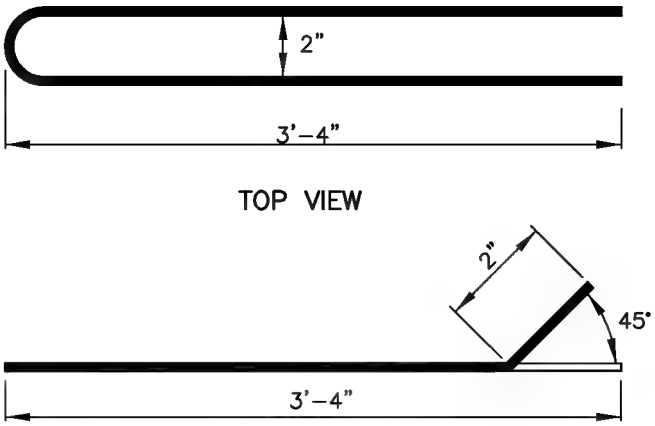
3/3



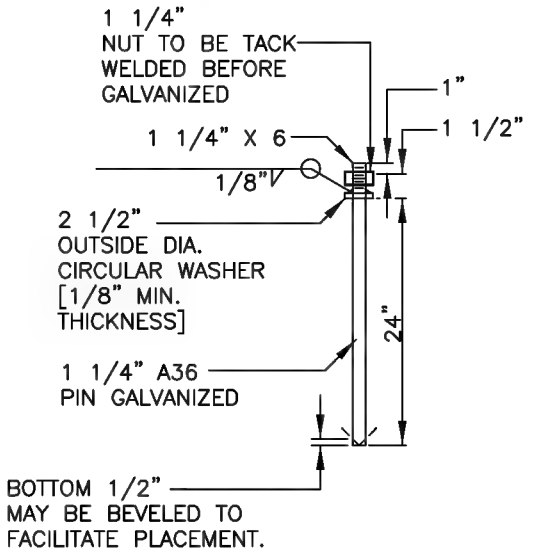
PLAN OF CONNECTION



SECTION A–A



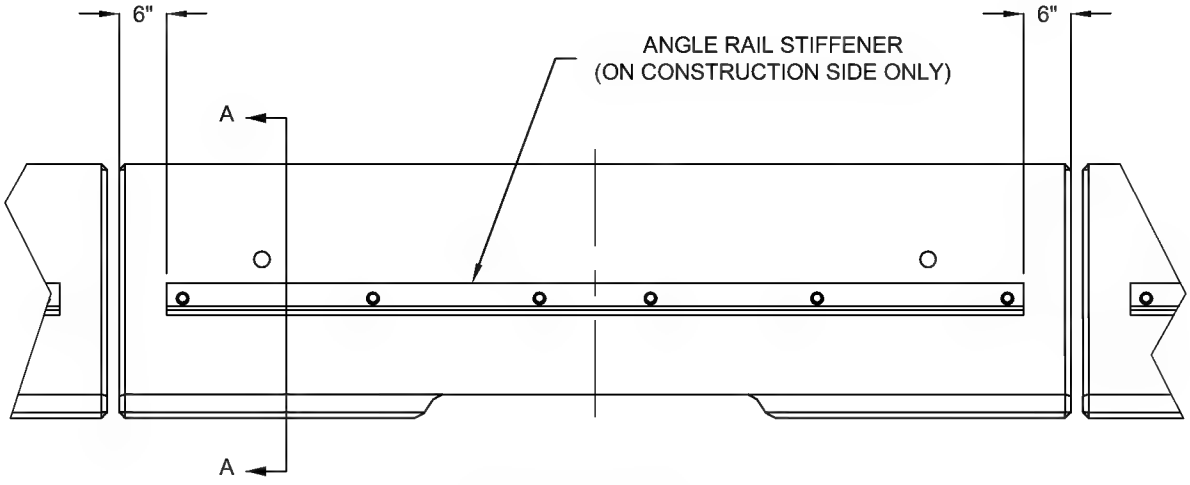
REINFORCEMENT DETAIL



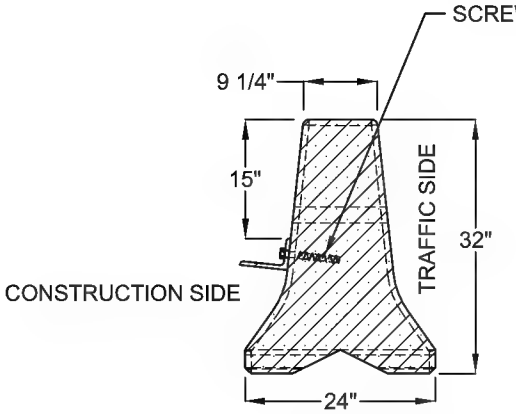
CONNECTOR PIN ASSEMBLY

DATE OF ISSUE
OCTOBER 2017

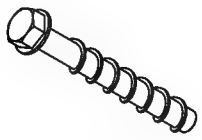
DRAWING NUMBER
E 403.3.0



ELEVATION VIEW
(CONSTRUCTION SIDE)
N.T.S.



SECTION A-A



SCREW ANCHOR

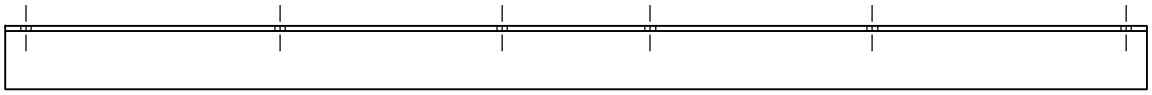
¾" X 7" SCREW ANCHOR WITH FACTORED DESIGN STRENGTHS IN 4,000 PSI CONCRETE WITH A 6 ¼" EMBEDMENT AS FOLLOWS: A MINIMUM 11,820 LBS IN TENSION AND A MINIMUM 25,455 LBS IN SHEAR.

TEST RESULTS
MASH 3-11 ON CONCRETE:

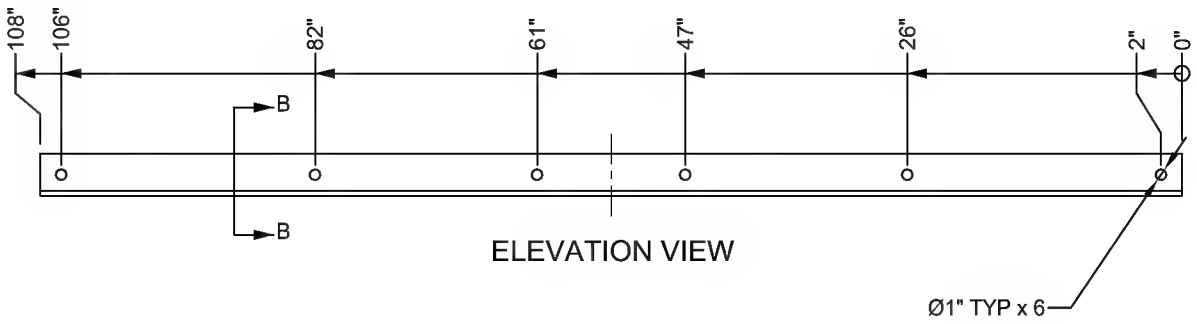
1. INSTALLATION LENGTH: 20 SEGMENTS
2. DYNAMIC DEFLECTION AT BASE: 59.0"
3. PERMANENT DEFLECTION AT BASE: 59.0"
4. WORKING WIDTH: 81.4"

NOTES:

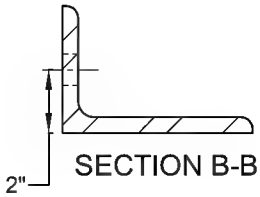
1. SEE MASSDOT DRAWING # E 403.2.0 FOR CONNECTION AND BARRIER DETAILS.
2. FOLLOW MANUFACTURER'S INSTRUCTION FOR INSTALLING SCREW ANCHORS.



PLAN VIEW



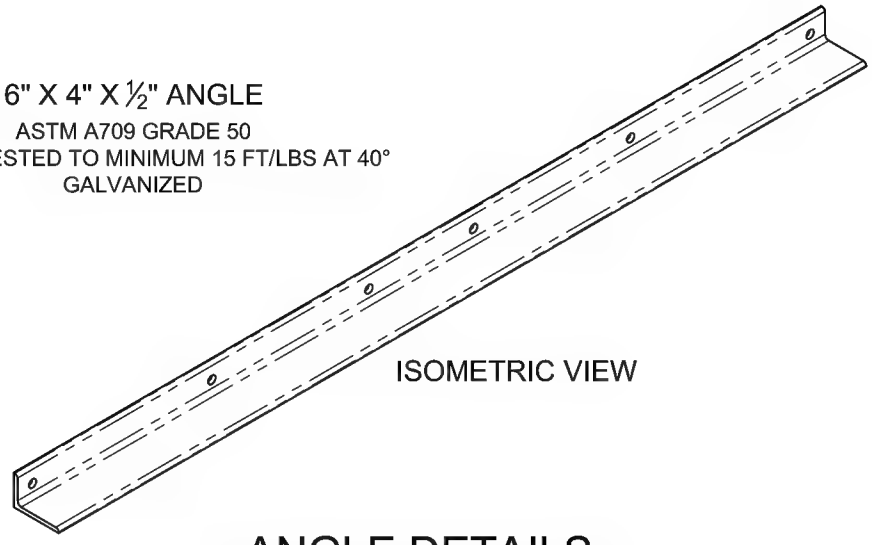
ELEVATION VIEW



SECTION B-B

6" X 4" X ½" ANGLE

ASTM A709 GRADE 50
CHARPY TESTED TO MINIMUM 15 FT/LBS AT 40°
GALVANIZED



ISOMETRIC VIEW

ANGLE DETAILS

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

TEMPORARY CONCRETE BARRIER RETROFITTED TO MASH TL-3

2/2

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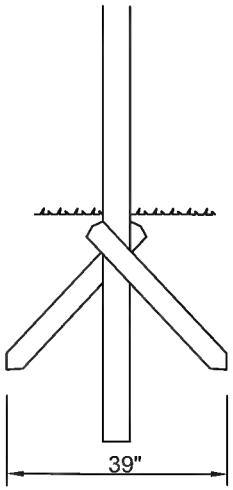
E 403.9.0

CONSTRUCTION STANDARDS

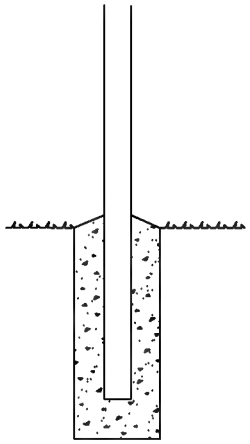
massDOT Highway Division
Massachusetts Department of Transportation

CHAIN LINK FENCE (SPRING TENSION WIRE)

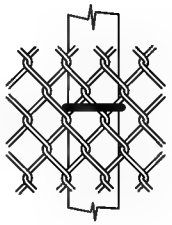


FABRIC PLACED PERPENDICULAR TO THE ANCHOR

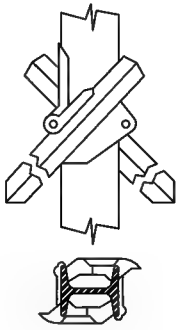
DETAIL SHOWING LINE POST SET WITH DRIVE ANCHORS



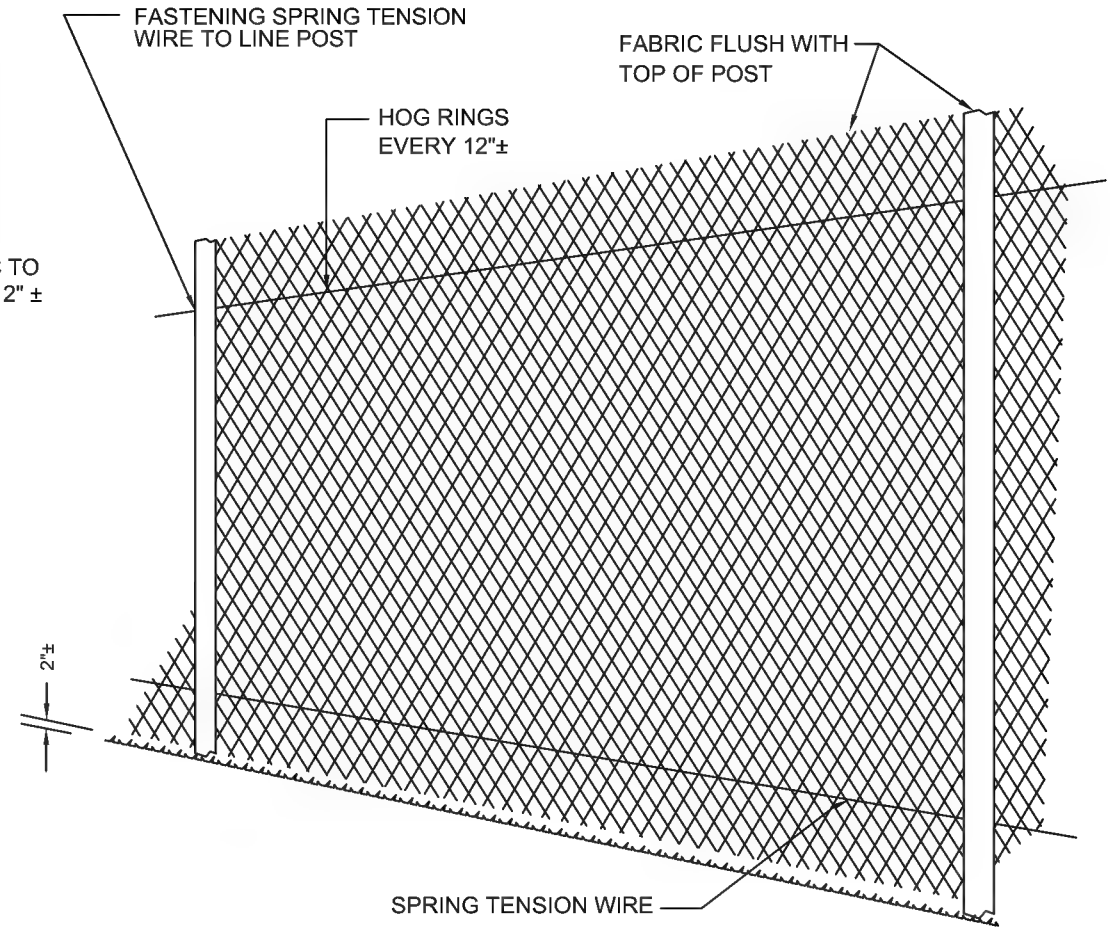
DETAIL SHOWING LINE POST SET IN CONCRETE FOOTING FOR DIMENSIONS SEE 404.5.0



FASTENING FABRIC TO LINE POST EVERY 12" ±



DETAIL OF AN ANCHOR CLAMP



CHAIN LINK FENCE WITH SPRING TENSION WIRE

LINE POSTS TO BE SPACED 10'-0" C. TO C. MAXIMUM EXCEPT ON CURVES WHERE THEY SHALL BE SPACED AS FOLLOWS:

CURVES 200' TO 500' RADIUS	8'-0" C. TO C. MAXIMUM
CURVES 100' TO 200' RADIUS	6'-0" C. TO C. MAXIMUM
CURVES LESS THAN 100' RADIUS	5'-0" C. TO C. MAXIMUM

LINE POST SPACING

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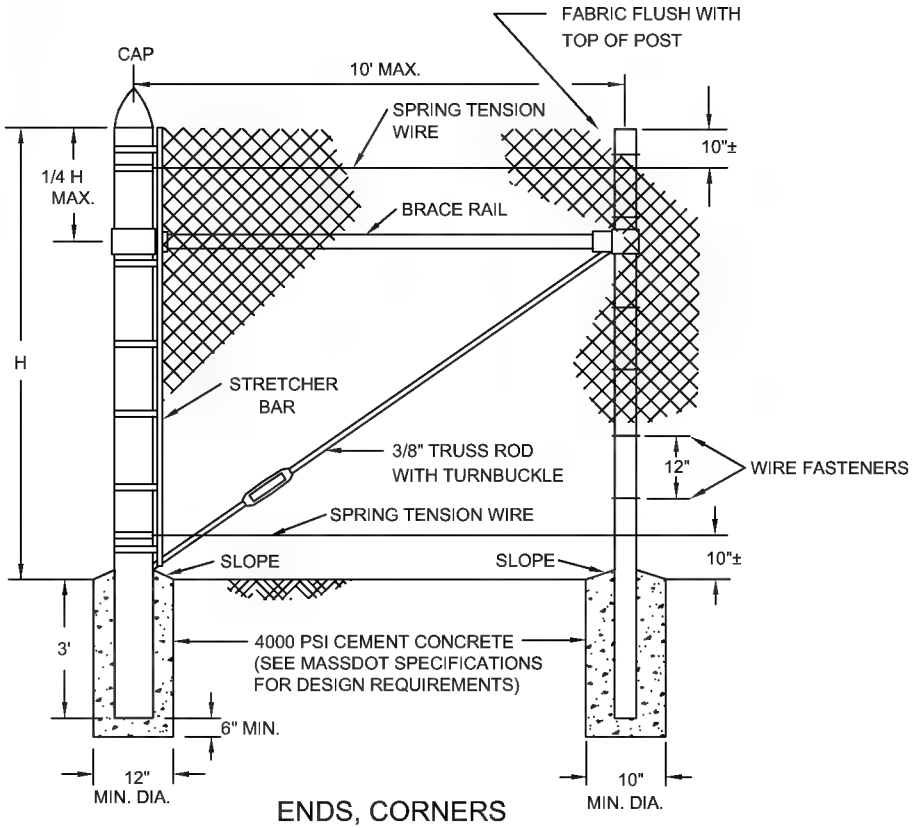
DRAWING NUMBER
E 404.1.0

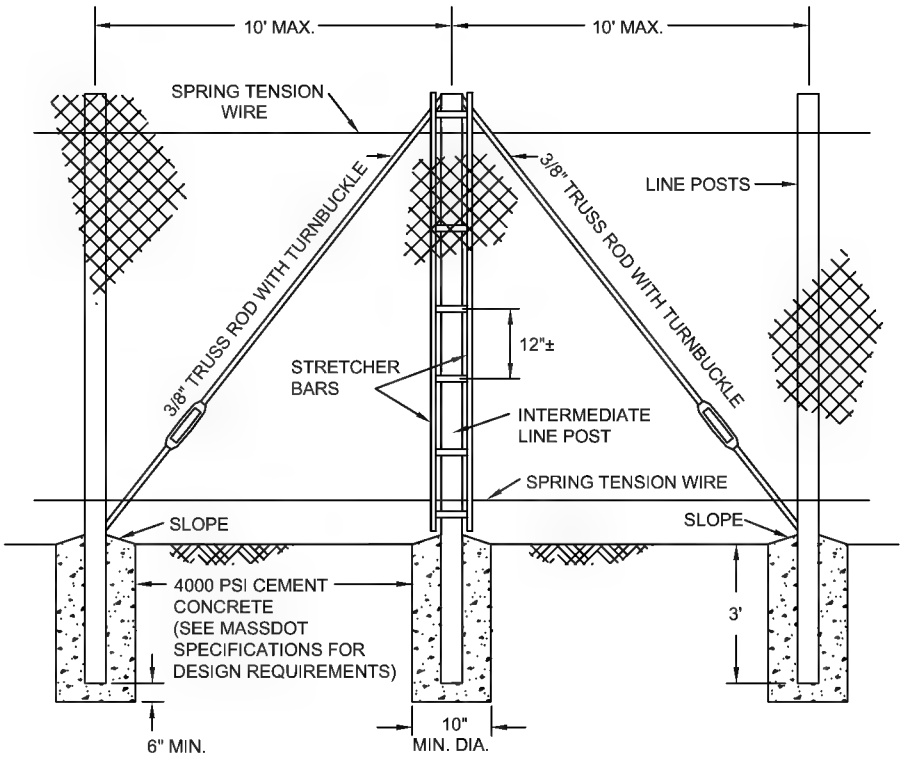
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

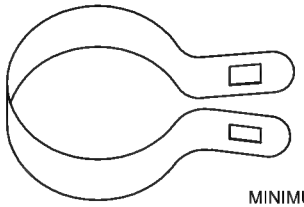
CHAIN LINK FENCE (SPRING TENSION WIRE)



ENDS, CORNERS



INTERMEDIATE POST



END BAND

SPRING TENSION WIRE

MINIMUM OF (5) TURNS AROUND THE SPRING TENSION WIRE TO END INSTALLATION. ALL BANDS SHALL BE ROUND ON ROUND POSTS.

NOTES:

1. FABRIC FOR FENCES 4' OR LESS IN HEIGHT; TOP SELVAGE TO HAVE KNUCKLED FINISH. BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED.
   FABRIC FOR FENCES 5' OR OVER IN HEIGHT; BOTH TOP AND BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED.
2. GRADE OF FENCE TO BE PARALLEL WITH THE GRADE OF SIDEWALKS, CURBING, GROUND OR TOP OF WALL.
3. INTERMEDIATE POST INTERVALS NOT TO EXCEED 500 FEET.
4. SPACING OF LINE POST ON CURVES, SEE DRAWING E 404.1.0
5. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.
6. SPRING TENSION WIRE TO BE FASTENED TO FABRIC WITH 11 GAUGE HOG RINGS AT 1' INTERVALS.
7. SPRING TENSION WIRE TO BE FASTENED TO LINE POSTS WITH CLIPS.
8. LINE POSTS TO BE DRIVEN EXCEPT WHERE NOTED ABOVE.

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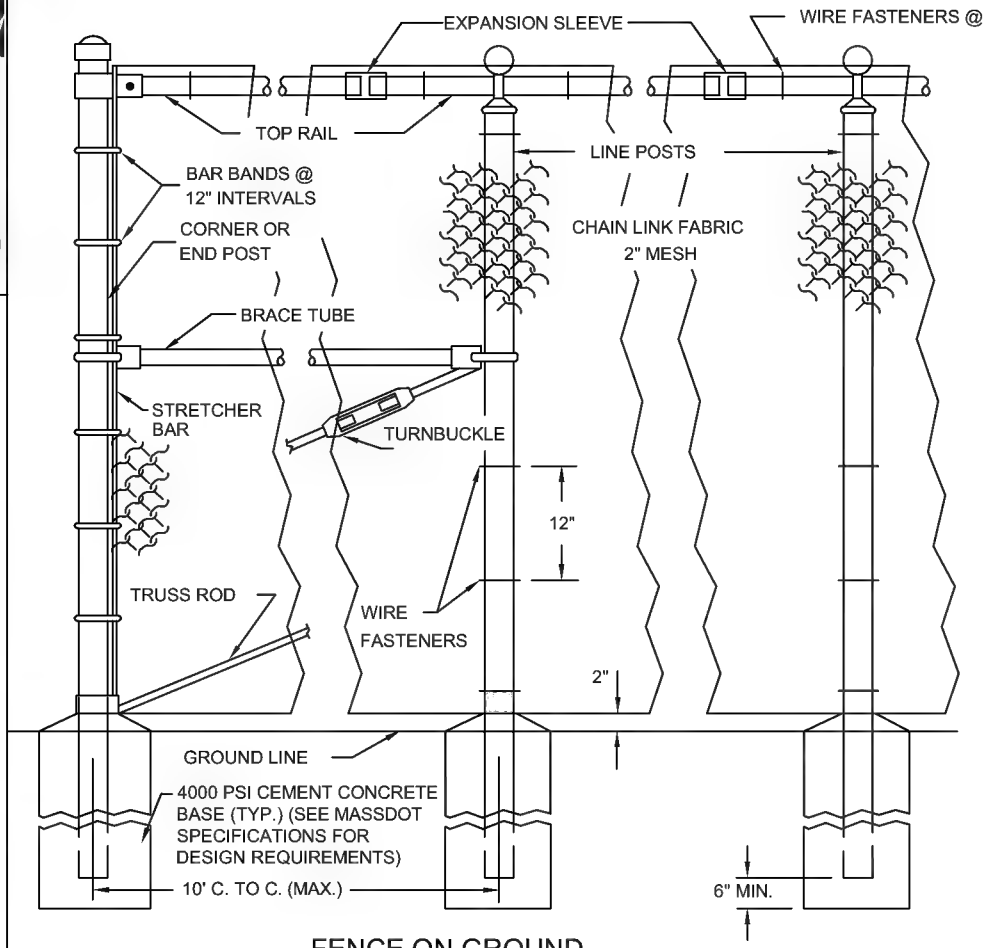
DRAWING NUMBER
E 404.2.0

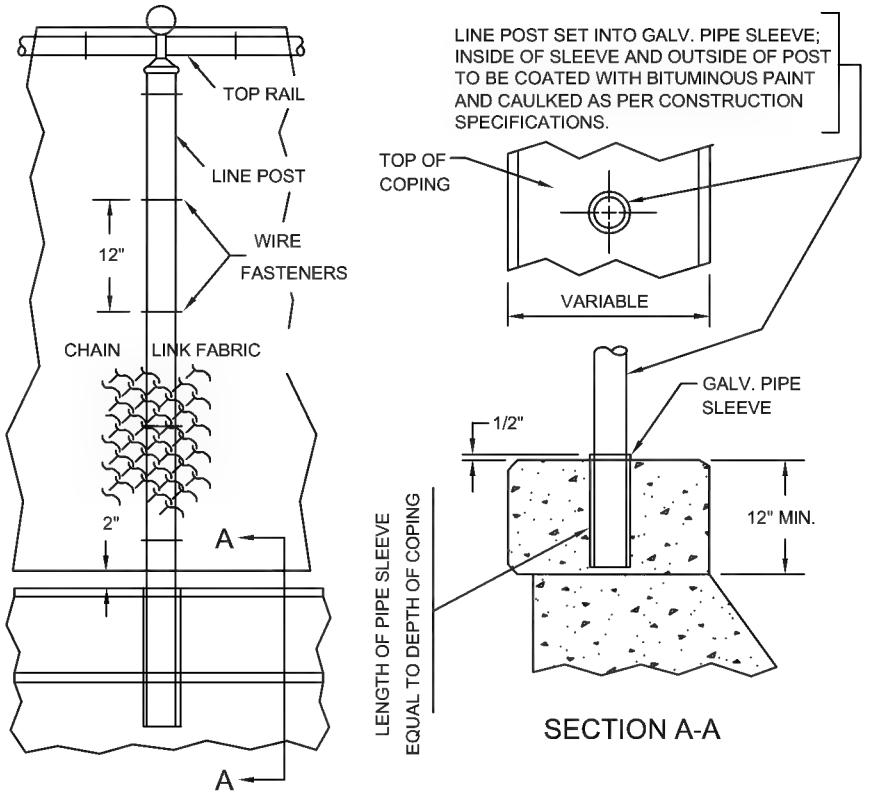
CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

CHAIN LINK FENCE (PIPE TOP RAIL)



FENCE ON GROUND



SECTION A-A

FENCE ON CONCRETE WALL

NOTES:

1. FABRIC FOR FENCES 4' OR LESS IN HEIGHT.
   TOP SELVAGE TO HAVE KNUCKLED FINISH. BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED.
   FABRIC FOR FENCES 5' OR OVER IN HEIGHT.
   BOTH TOP AND BOTTOM SELVAGE TO HAVE TWISTED AND BARBED FINISH UNLESS OTHERWISE NOTED.
2. THE HEIGHT OF FENCE TO BE AS SPECIFIED.
3. GRADE OF FENCE TO BE PARALLEL WITH THE GRADE OF SIDEWALKS, CURBING, GROUND OR TOP OF WALL.
4. LINE POSTS TO BE SPACED 10'-0" C. TO C. MAXIMUM EXCEPT ON CURVES WHERE THEY SHALL BE SPACED AS FOLLOWS:

CURVES 200' TO 500' RADIUS	8'-0" C. TO C. MAXIMUM
CURVES 100' TO 200' RADIUS	6'-0" C. TO C. MAXIMUM
CURVES LESS THAN 100' RADIUS	5'-0" C. TO C. MAXIMUM

5. FOR POST BASES AND CABLE ATTACHMENTS, SEE DRAWING E 404.5.0
6. FOR DESCRIPTION, MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD SPECIFICATIONS.

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DRAWING NUMBER
E 404.4.0

CONSTRUCTION STANDARDS

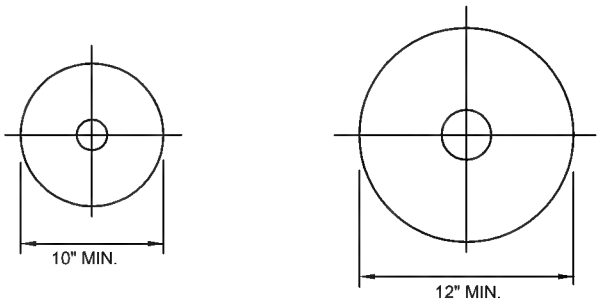
massDOT Highway Division
Massachusetts Department of Transportation

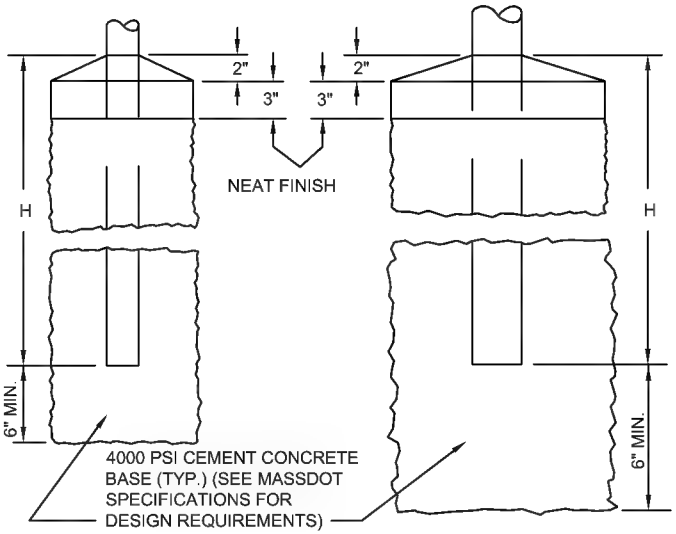
CHAIN LINK FENCE DETAILS OF CABLE ATTACHMENTS AND POST BASES

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 404.5.0

POST BASES

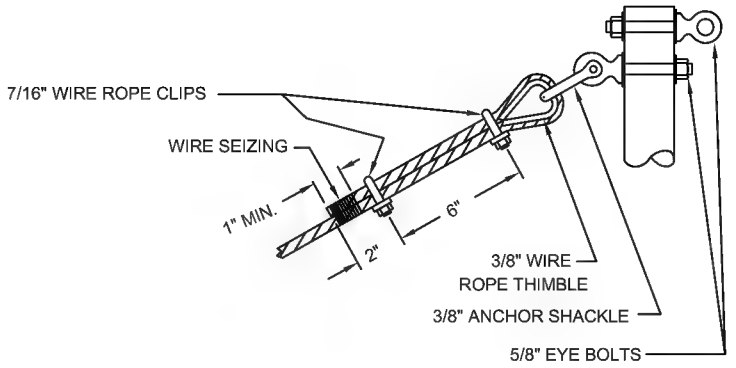




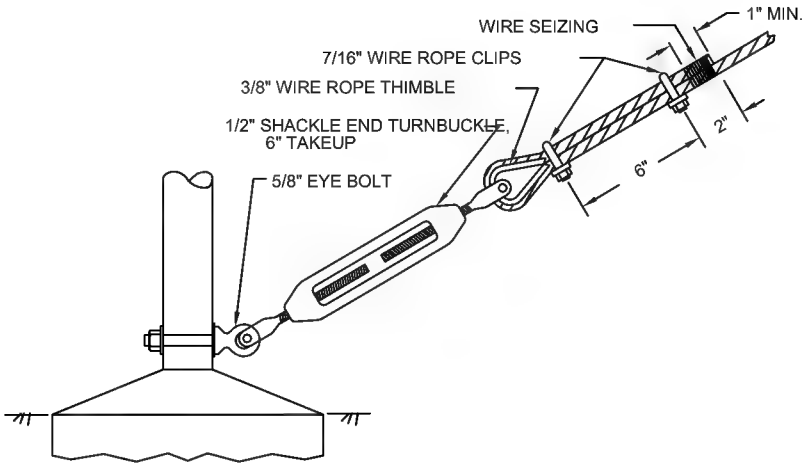
FOR CORNER, END LINE AND PULL POSTS

FOR GATE POSTS

FENCE HEIGHT	MIN. H
5' OR LESS	2'-6"
OVER 5'	3'-0"



FOR END PULL POST



FOR FASTENING TO BASE OF POST

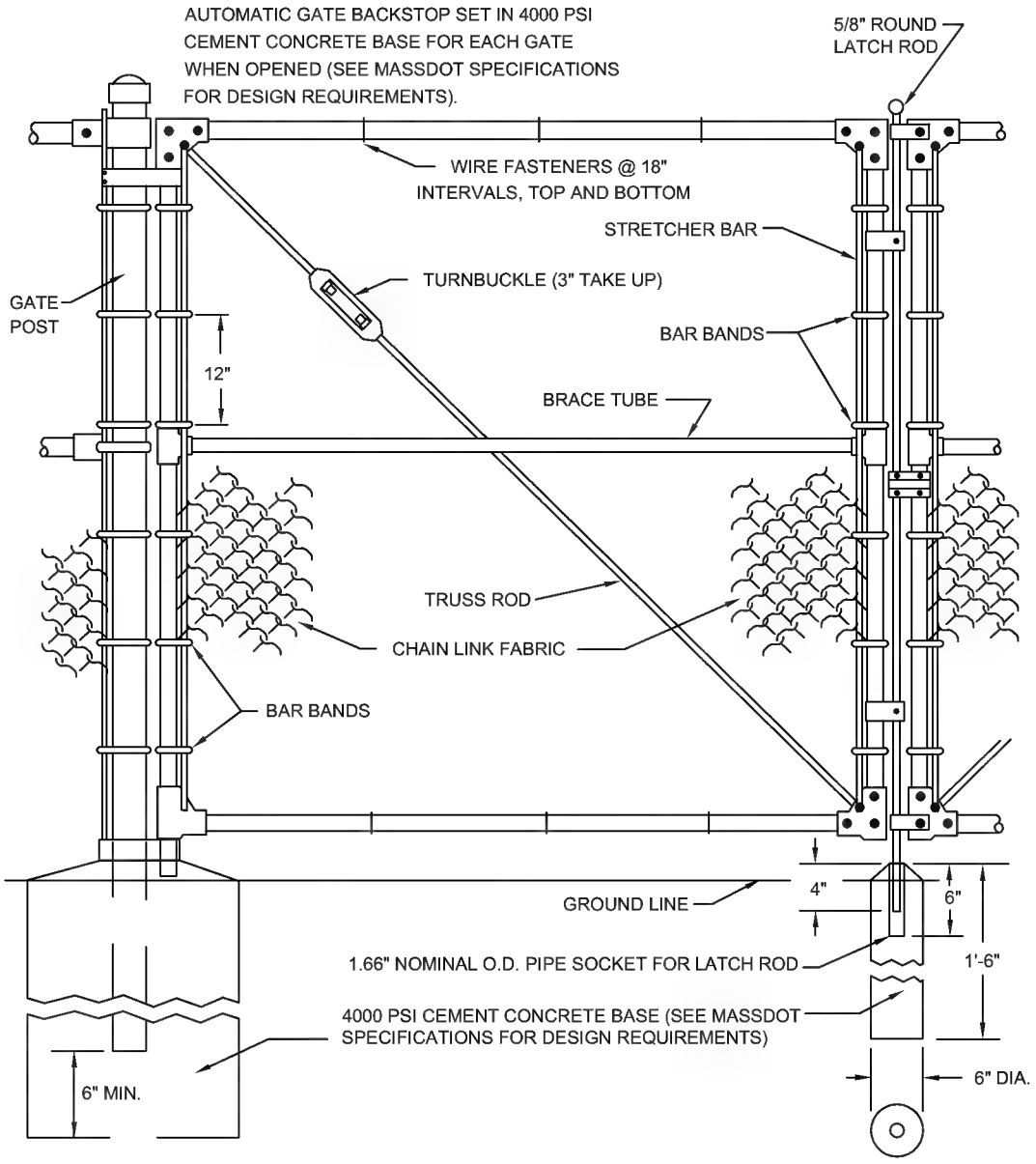
NOTE:
1. FOR EYE BOLT INSTALLATION THROUGH PIPE SECTIONS, USE 2 WASHERS ON "SHOULDER SIDE" AND 1 WASHER WITH LOCK WASHER ON "NUT SIDE" OF POSTS.

DETAILS OF CABLE ATTACHMENTS

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

CHAIN LINK FENCE - SWING GATE



DOUBLE GATES

END POSTS TO BE USED ON LATCH SIDE OF SINGLE GATE OPENINGS.

1. CHAIN LINK FABRIC FOR GATES TO BE THE SAME AS REQUIRED FOR FENCE.

2. FOR GATE POST BASE, SEE DRAWING 404.5.0

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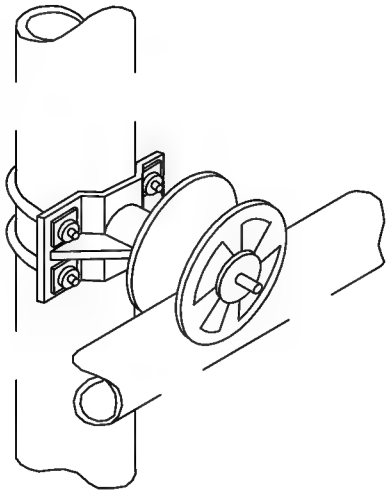
DRAWING NUMBER
E 404.6.0

CONSTRUCTION STANDARDS

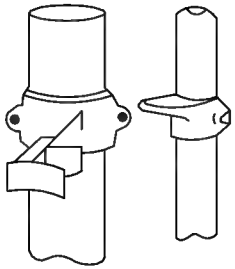
massDOT Highway Division

CHAIN LINK FENCE
CANTILEVER GATE

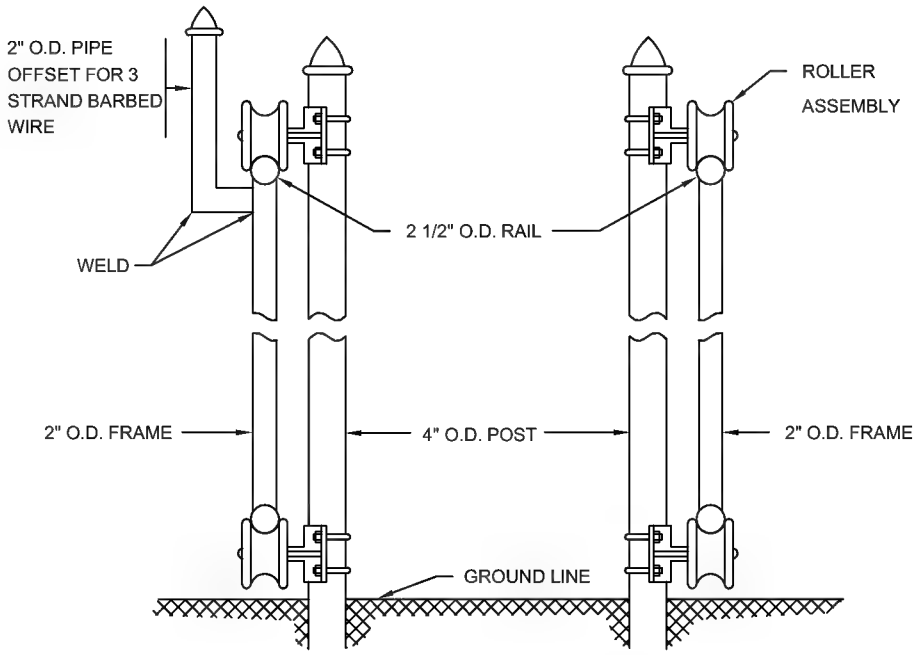


WHEEL EQUIPPED WITH ROLLER BEARINGS
AND LUBRICATION FITTING.
MASSIVE MALLEABLE CONSTRUCTION.
4 ASSEMBLIES NEEDED PER SECTION.

ROLLER ASSEMBLY



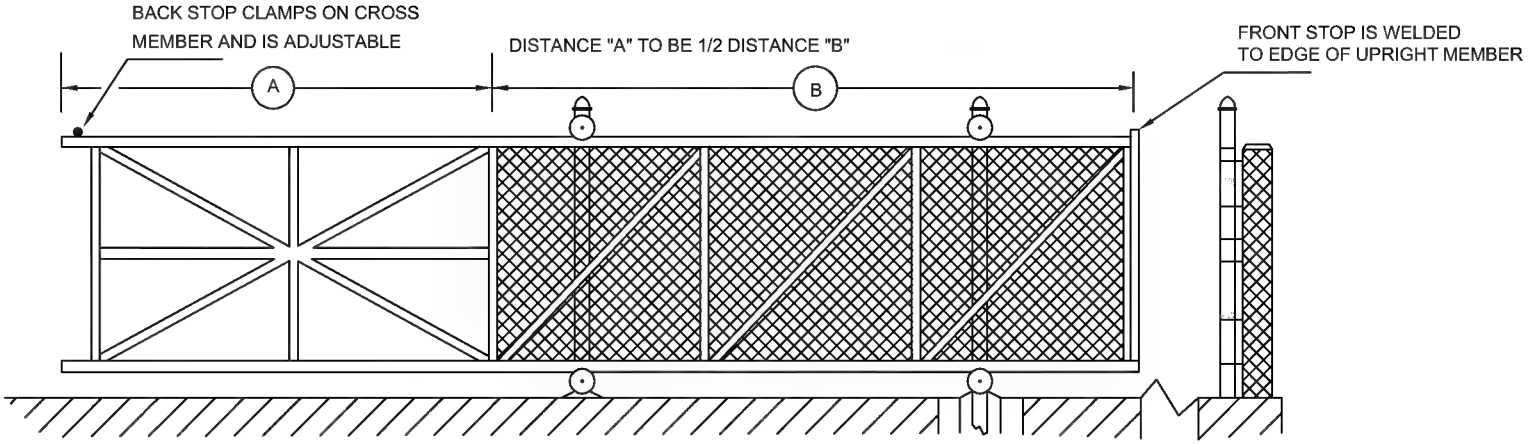
LATCH AND LOCKING
ASSEMBLY



SPECIFICATIONS OF GATE FRAME

TOP AND BOTTOM MEMBER---------- 2 1/2" O.D. PIPE
UPRIGHT MEMBERS---------- 2" O.D. PIPE
HORIZONTAL AND DIAGONAL BRACES----- 1 5/8" O.D. PIPE

SIDE VIEW SHOWING TRUSS TYPE CONSTRUCTION



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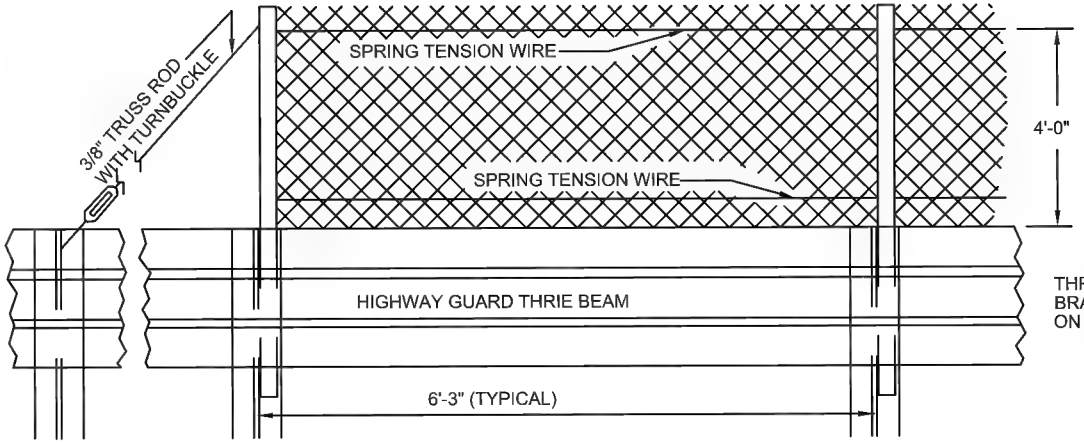
DRAWING NUMBER
E 404.7.0

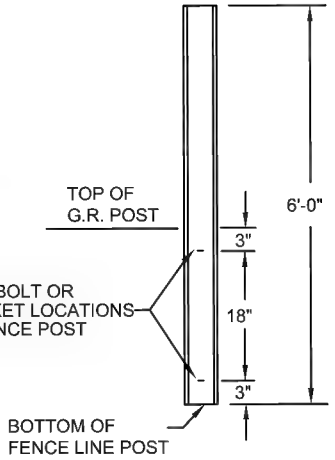
CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

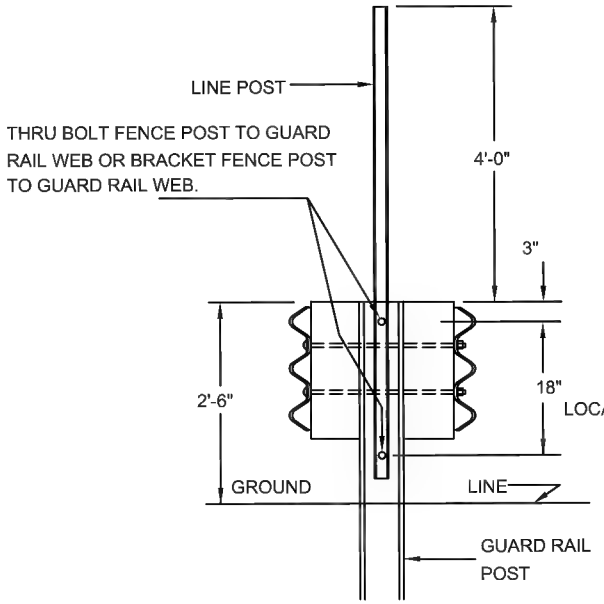
CHAIN LINK FENCE MOUNTED ON GUARD RAIL



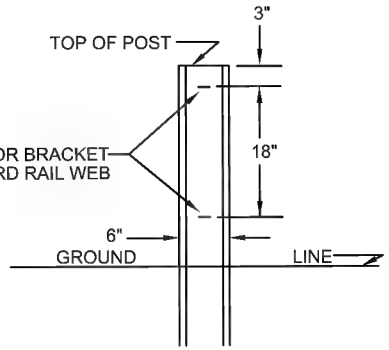
ELEVATION



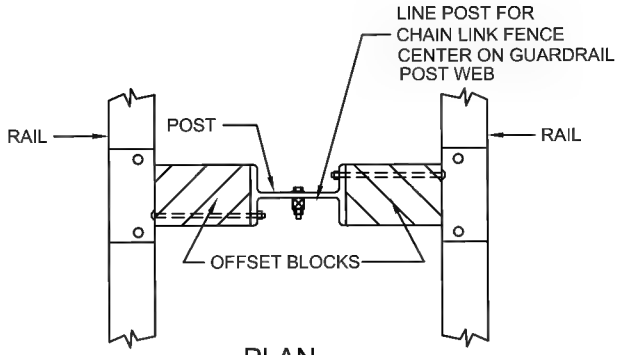
CHAIN LINK FENCE POST



ELEVATION



G.R. POST



PLAN

NOTES:

1. ALL POSTS (LINE, END, AND INTERMEDIATE) SHALL CONFORM TO DETAILS SHOWN ON DRAWING E 404.1.0
2. END BRACING TO CONFORM TO DETAIL SHOWN ABOVE. INTERMEDIATE BRACING SHALL BE IN CONFORMANCE TO DETAILS SHOWN ON DRAWING E 404.2.0
3. FOR DESCRIPTION, MATERIALS AND METHODS, SEE STANDARD SPECIFICATIONS.
4. SHALL USE A ROUND OR C FENCE POST

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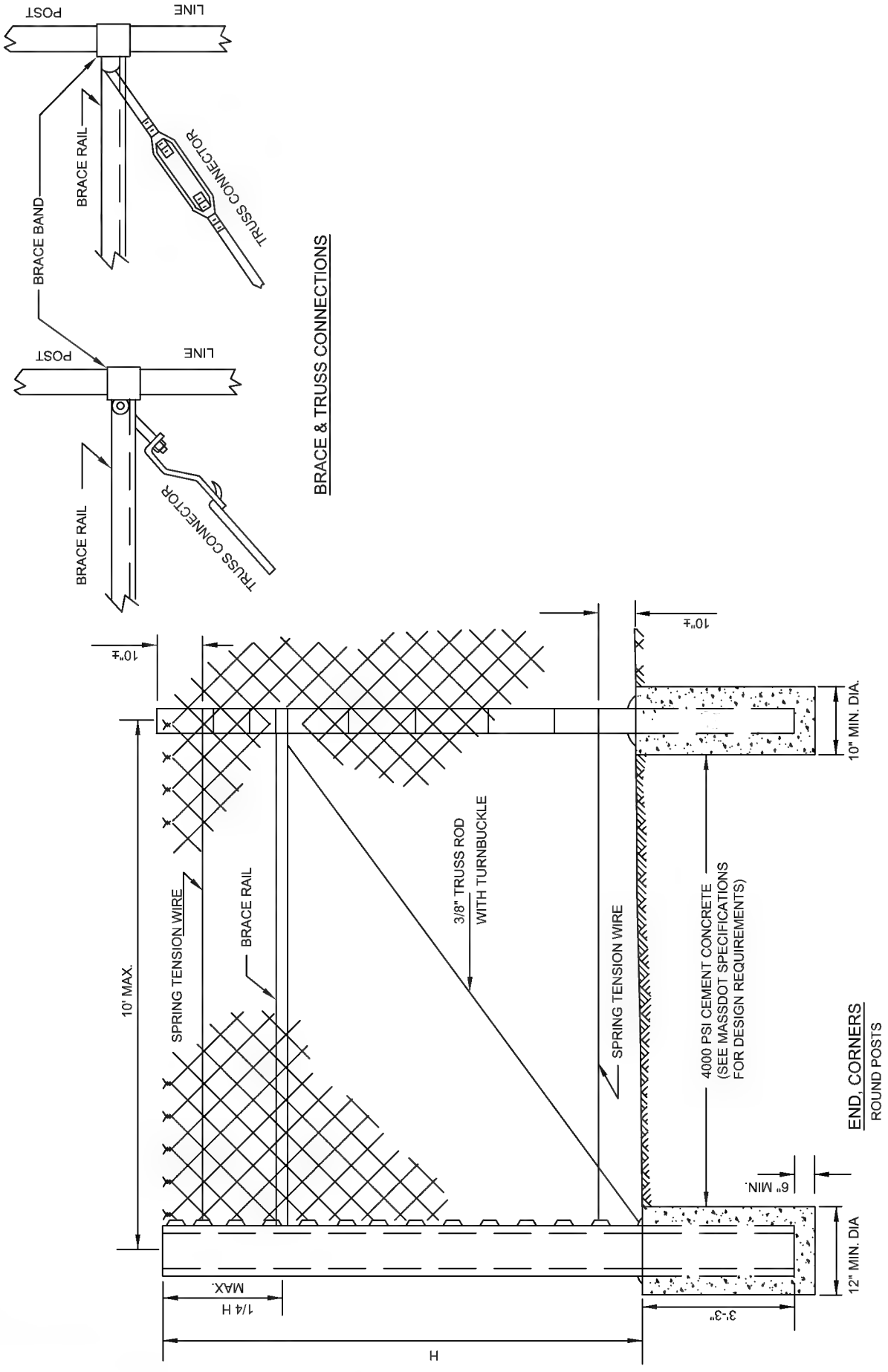
DRAWING NUMBER
E 404.8.0



massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

CHAIN LINK FENCE POST DETAILS

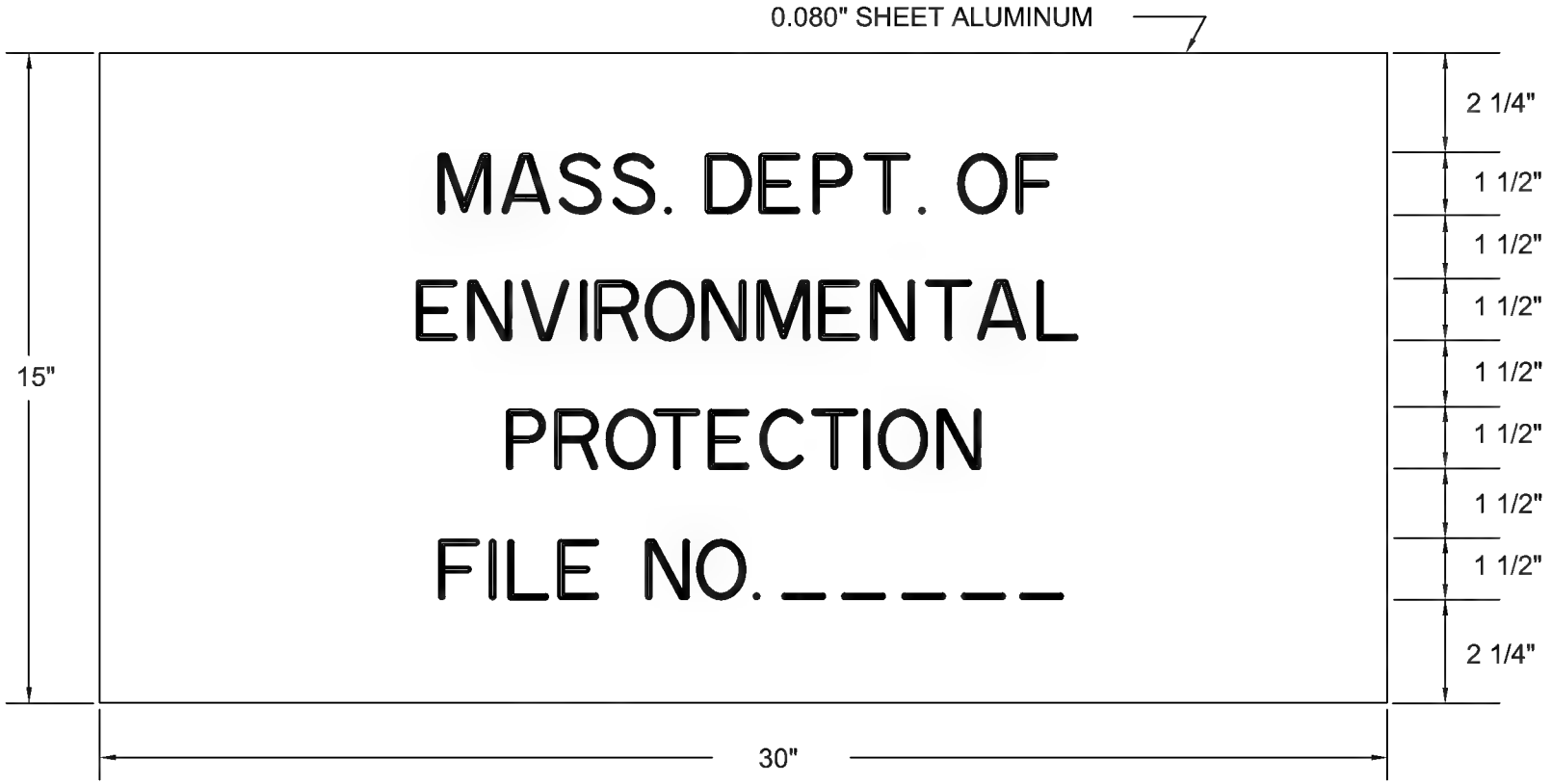
DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 404.10.0

CONSTRUCTION STANDARDS

massDOT Massachusetts Department of Transportation Highway Division

WETLANDS PROTECTION ACT SIGN



COLORS — LEGEND - BLACK (NON-REFLECTORIZED)
BACKGROUND - WHITE (REFLECTORIZED)

THE SIGN IS TO BE MOUNTED ON A MASSDOT HIGHWAY DIVISION STANDARD "P-5" POST

NOTES:

1. THE SIGN IS PLACED ON ALL PROJECTS SUBJECT TO THE PROVISIONS OF THE MASSACHUSETTS WETLANDS PROTECTION ACT.
2. THE LOCATION OF THE SIGN IS TO BE DETERMINED BY THE ENGINEER.
3. SEE SPECIAL PROVISIONS FOR THE MANUFACTURE, MAINTENANCE, ERECTION AND REMOVAL RESPONSIBILITIES.
4. USE SERIES "D" FOR LETTERING.

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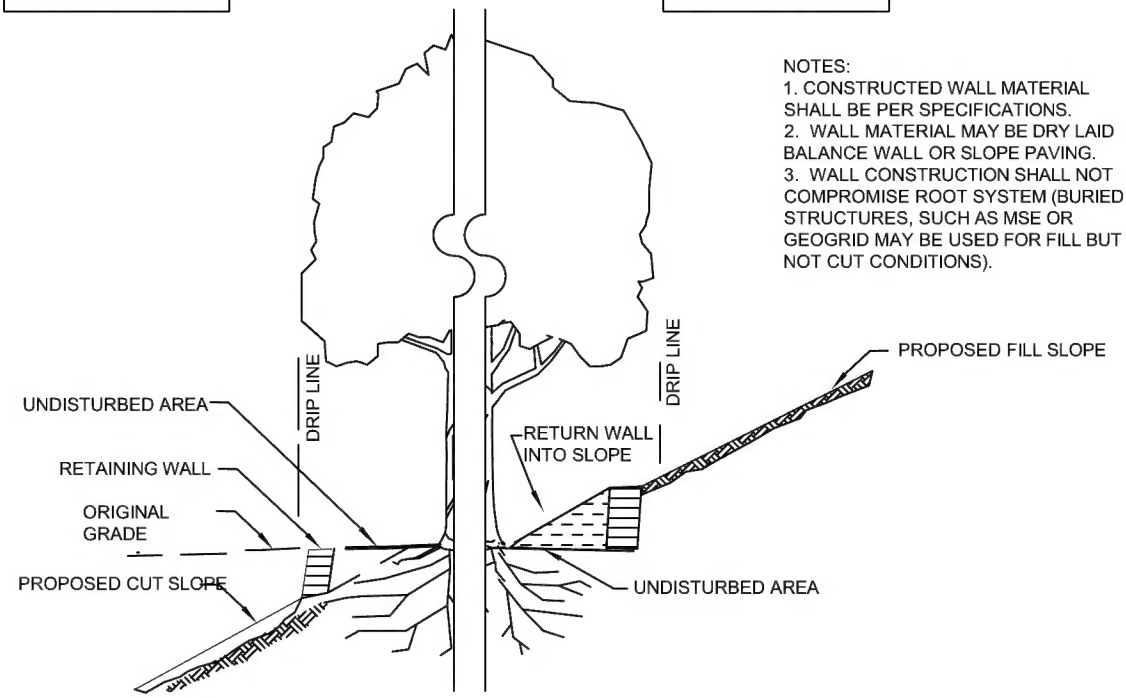
DRAWING NUMBER
E 501.1.0

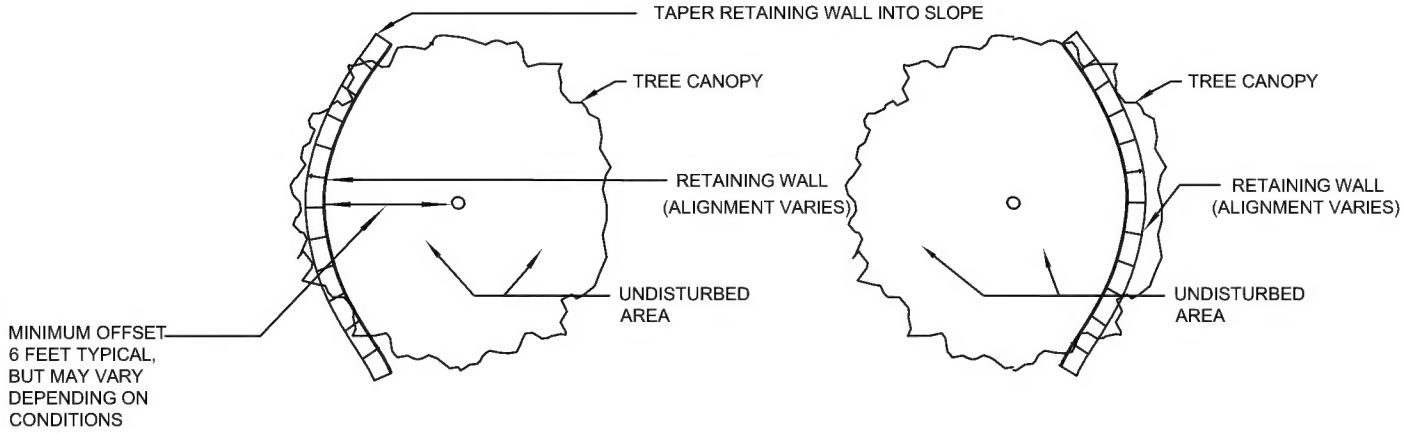
CUT CONDITION

FILL CONDITION

NOTES:
1. CONSTRUCTED WALL MATERIAL SHALL BE PER SPECIFICATIONS.
2. WALL MATERIAL MAY BE DRY LAID BALANCE WALL OR SLOPE PAVING.
3. WALL CONSTRUCTION SHALL NOT COMPROMISE ROOT SYSTEM (BURIED STRUCTURES, SUCH AS MSE OR GEOGRID MAY BE USED FOR FILL BUT NOT CUT CONDITIONS).



SECTION VIEW



CUT CONDITION

FILL CONDITION

PLAN VIEW

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

TREE WELLS

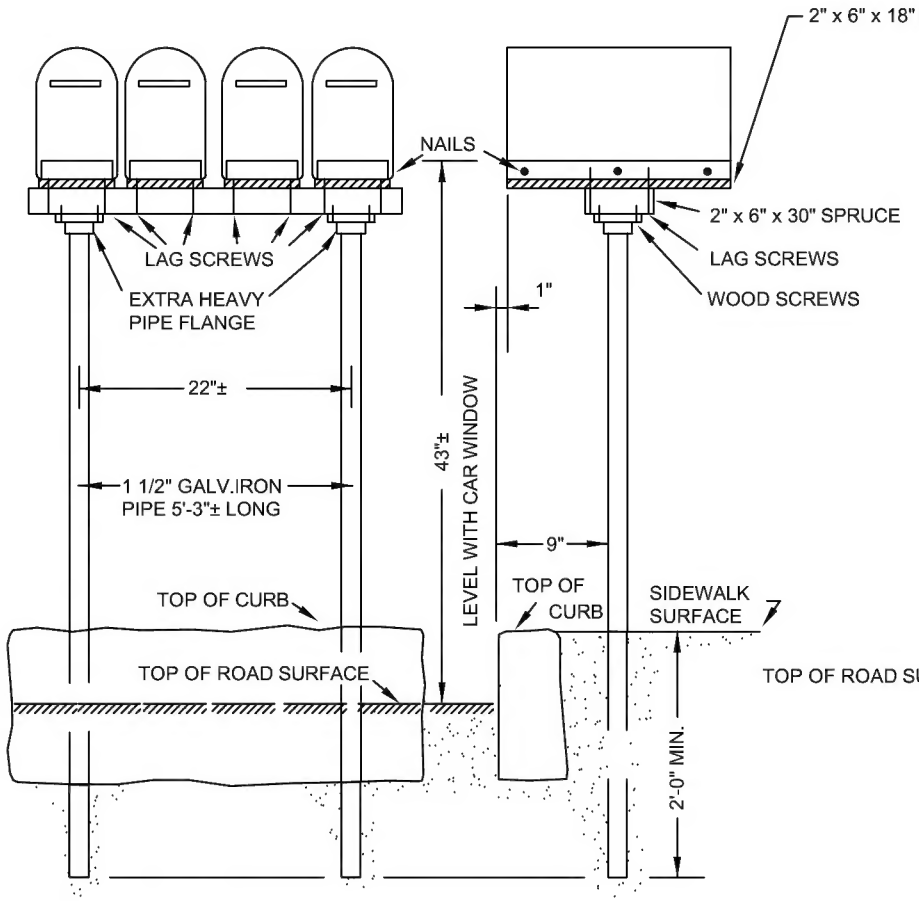
DATE OF ISSUE
OCTOBER 2017

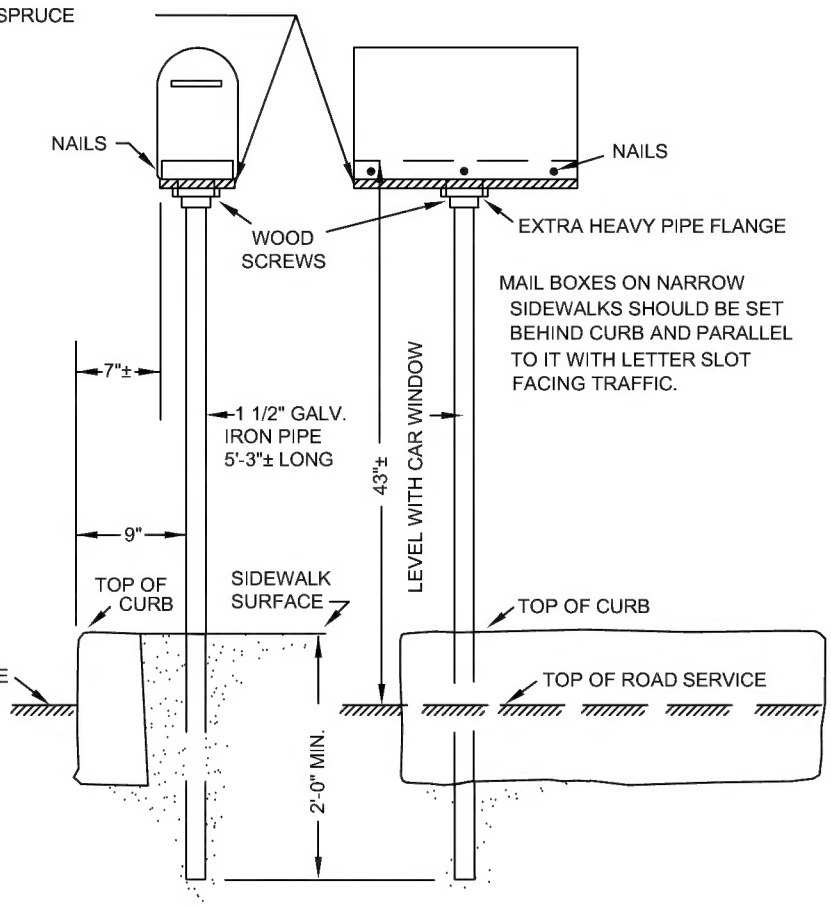
DRAWING NUMBER
E 502.1.0

CONSTRUCTION STANDARDS

massDOT Highway Division
Massachusetts Department of Transportation

SETTING RURAL MAILBOXES





NOTES:

1. LUMBER TO BE PLANED ON ALL FOUR SIDES TO FULL 2" x 6" SIZE TO FIT BOTTOM OF MAIL BOXES.
2. TO SET 1 1/2" GALVANIZED PIPE POST, USE DRIVING POINT OF SAME SIZE, THEN TAMP POST INTO PLACE SO AS TO BE PLUMB BOTH WAYS.
3. ALL FITTINGS (PIPE FLANGES, PIPE, SCREWS, NAILS, ETC.) ARE TO BE GALVANIZED.
4. FOR DESCRIPTIONS, MATERIALS, AND CONSTRUCTIONS METHODS SEE STANDARD SPECIFICATIONS.
5. A 4" X 4" PRESSURE TREATED WOOD POST MAY BE SUBSTITUTED FOR A PIPE POST.

DATE OF ISSUE
OCTOBER 2017

DRAWING NUMBER
E 504.1.0

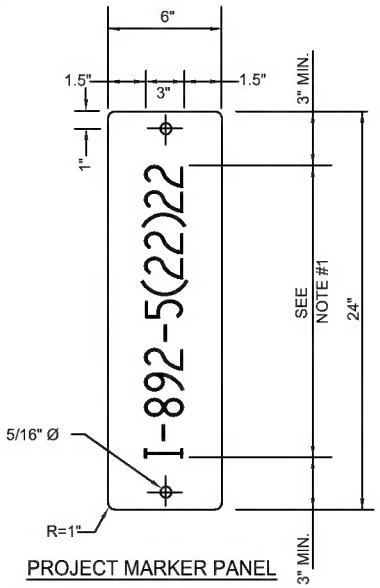
CONSTRUCTION STANDARDS

massDOT Highway Division — Massachusetts Department of Transportation

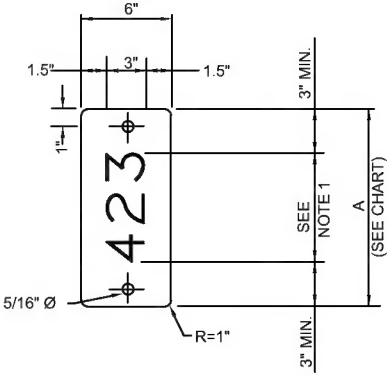
DEMOUNTABLE REFLECTORIZED STATION MARKER AND PROJECT MARKER

DRAWING NUMBER **E 505.1.0**

DATE OF ISSUE OCTOBER 2017

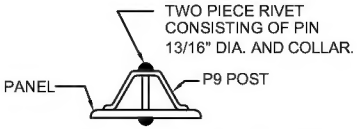


PROJECT MARKER PANEL

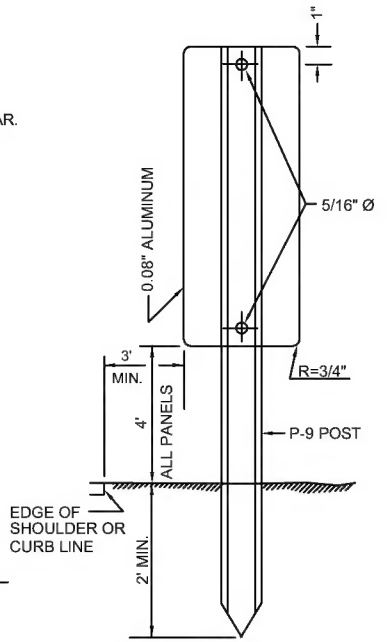


STATION MARKER PANEL

# OF DIGITS	A inches
1	8
2	11
3	13



METHOD OF ATTACHING PANEL TO P-9 POST

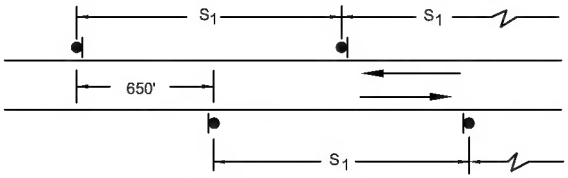


TYPICAL MARKER INSTALLATION

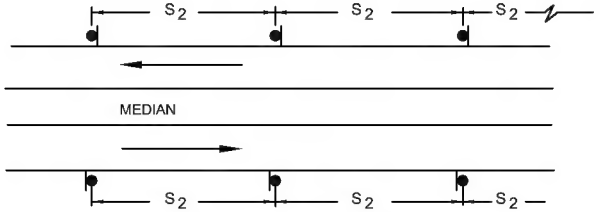
SPACING OF STATION NUMBERS

S_1 - 1300', BOTH SIDES, STAGGER

S_2 - 650', BOTH SIDES

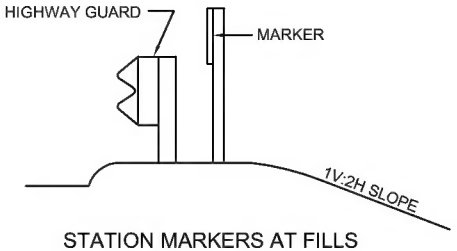


SINGLE ROADWAY

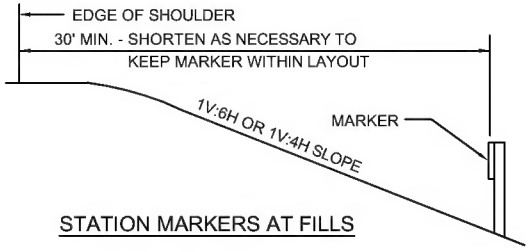


DIVIDED ROADWAY

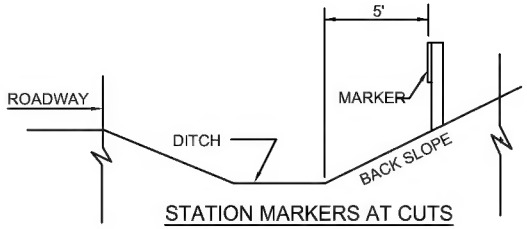
OMIT MARKERS FROM INTERCHANGE



STATION MARKERS AT FILLS



STATION MARKERS AT FILLS



STATION MARKERS AT CUTS

NOTES:

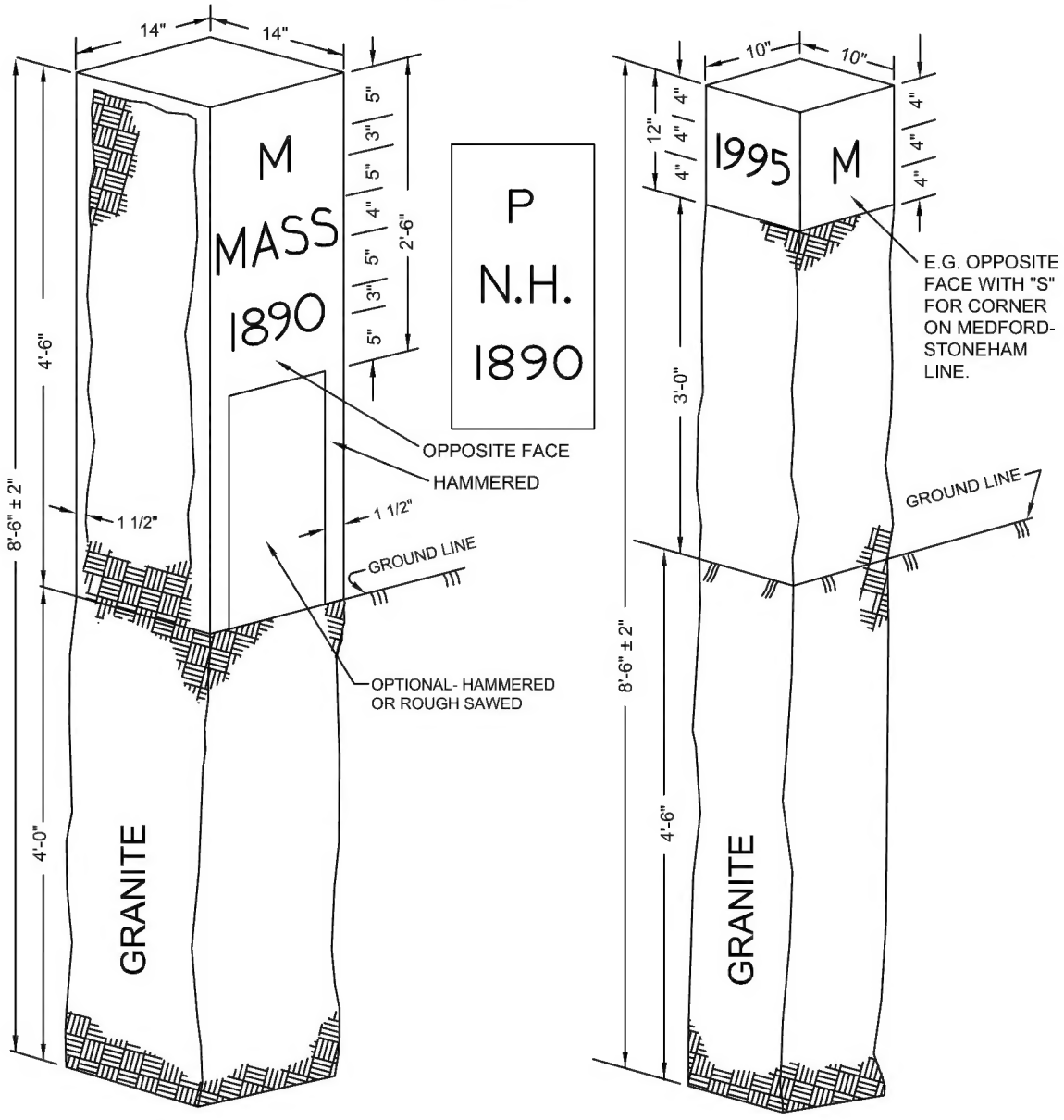
1. THE LEGEND IS TO BE CENTERED AND THE SPACING OF THE CHARACTERS IS TO CONFORM TO THE FEDERAL HIGHWAY ADMINISTRATION RECOMMENDATION FOR SERIES "C" TYPE LETTERING.
2. THE STATION DESIGNATIONS ARE TO BE EVEN STATIONS i.e. NO PLUS STATIONS.
3. THE PANELS FOR THE LEGEND ARE TO BE 0.08" SHEET ALUMINUM. FABRICATED AND FINISHED ACCORDING TO THE STANDARD SPECIFICATIONS.
4. THE LETTERS AND NUMERALS AND METHOD OF APPLICATIONS ARE DESCRIBED IN THE STANDARD SPECIFICATIONS.
5. ALL PANELS ARE TO BE MOUNTED ON NEW P-9 POST IN THE MANNER DESCRIBED IN THE STANDARD SPECIFICATIONS.
6. ONE MARKER IS TO BE PROVIDED AT CULVERT END, WHERE NO GUARD RAIL IS INSTALLED IT IS TO BE LOCATED AT THE NEAR BACK CORNER OF THE END IN THE DIRECTION OF TRAFFIC.
7. MARKERS ARE TO BE PLACED AT 650' INTERVALS; ON UNDIVIDED ROADWAY STAGGER ON EACH SIDE, ON DIVIDED ROADWAY PLACE MARKERS OPPOSITE EACH OTHER.
8. SEE DRAWING E TR.2.3 FOR P-9 POST DIMENSIONS.

REPLACEMENT OF BOUND BROKEN OR LOST WILL BE INSCRIBED WITH THE YEAR BOUND POINT WAS ESTABLISHED.

BOUNDS LOCATING NEW CORNERS WILL BE INSCRIBED WITH THE YEAR NEW CORNER WAS ESTABLISHED.

ALL LETTERING TO BE

1/2" V SUNK LETTERS



STATE LINE

CITY OR TOWN CORNER

NOTES:

1. TOP AND 4 SIDES FOR A DISTANCE OF 12" TO BE HAMMERED SMOOTH.
2. IN SPECIFIED LOCATIONS, MONUMENTS MAY BE HAMMERED SMOOTH ON TOP AND 4 SIDES ABOVE GROUND LINE.
3. FOR DESCRIPTIONS, MATERIALS AND CONSTRUCTION METHODS SEE STANDARD SPECIFICATIONS.

massDOT Massachusetts Department of Transportation Highway Division

CONSTRUCTION STANDARDS

BOUND LETTERED GRANITE

DATE OF ISSUE
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